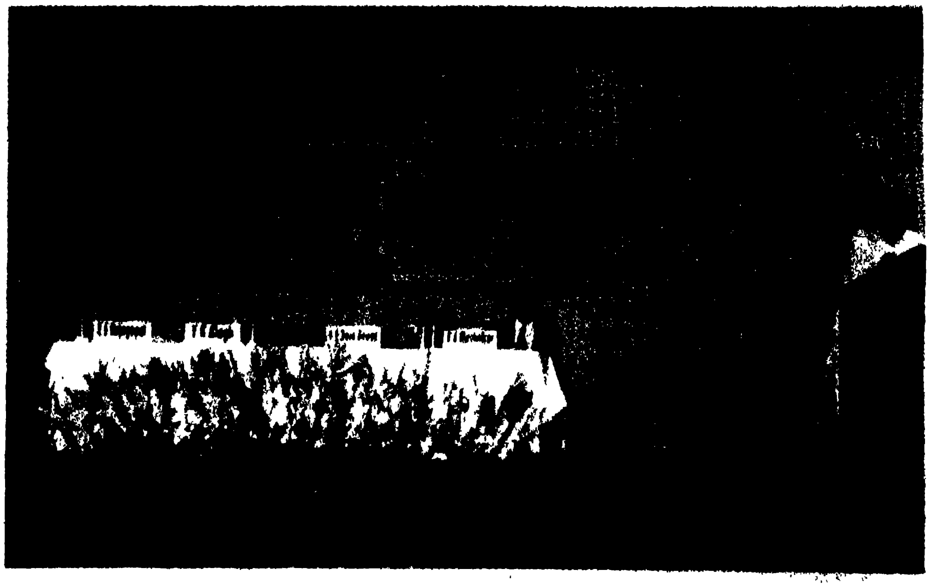
0409-7467

CSIR NEWS

OL 47 NO 1 15 JANUARY 1997

Prime Minister presents Shanti Swarup Bhatnagar and CSIR Golden Jubilee Prizes

PRIME Minister Shri H.D. Deve Gowda, who is also the President of the Council of Scientific & Industrial Research, presented the Shanti Swarup Bhatnagar Prizes for 1996 and the CSIR Golden Jubilee Prizes at a glittering function held in the NPL auditorium, New Delhi, on 20 December 1996. Attended by a large galaxy of distinguished scientists, the function was presided over by Prof. Y.K. Alagh, Minister of State for Science & Technology and Vice President, CSIR.



Prime Minister Shri H.D. Deve Gowda addressing the scientists. Sitting on the dais (from right) are: Dr R.A. Mashelkar, Director General, CSIR; Prof. Y.K. Alagh, Minister of State for S&T and Vice President, CSIR; and Prof E.S. Rajagopal, Director, NPL

Congratulating the CSIR Golden Jubilee Medal winners — Prof. C.N.R. Rao and Prof. G. N. Ramachandran — the Prime Minister said, "These distinguished sons of India have made pioneering contributions in physical sciences and life sciences and have done India proud. I am sure their achievements will inspire the young scientists of India." Regarding the Bhatnagar Prizes, Shri Deve Gowda observed, "Ever since its inception in 1957, this award has symbolized excellence of the highest order. I am happy that the award goes to young scientists who are less than 45 years of age. As we know, many of the award-winners of earlier years have become leaders of science in India."

Shri Deve Gowda further said, "As India enters the twenty-first century, there will be new challenges that it will be facing. India's intellectual prowess is second to none. Our scientists have done us proud through their numerous achievements. But as we enter the Golden Jubilee of India's Independence, we must apply our minds to identify those areas where India will establish undisputed leadership. Let us also remember that although knowledge flows freely in today's interconnected world, the usable knowledge does not flow freely. It is also not available free. The future industrial development in India cannot be entirely based on borrowed technology. We have been seekers of technology from the West. I want to urge our scientists and technologists to have a vision of India becoming a major exporter of technology. Indian science must not only make economic sense but it must make social sense also. Solutions to many problems facing India today, which are connected with health, environment, housing, etc. need solutions. These can only be science based."

"To meet the challenges of the future, we need urgent action. We will have to review our Science and Technology priorities. We must restructure and debureaucratize our universities and publicly funded R&D institutions to give them the flexibility and freedom of operation. We need to strengthen the science-business link. We want our industry to look at research and academic institutions as 'idea generators' as well as 'window of knowledge' to the rest of the world. My government is determined to make every effort to strengthen such linkage and in turn industrial research and development. One such opportunity has been provided through the many fiscal incentives that my Government has announced in this budget. The Technology Development Fund has now become operational and I hope that the industry will make full use of it."

Referring to a suggestion made by Prof. Y.K. Alagh that a new fund be created for scientists working in frontier areas of Science & Technology, the Prime Minister assured that the suggestion will be given due consideration by the Government.

Presiding over the function, Prof. Y.K. Alagh said that the Bhatnagar awardees are the people who can work anywhere in the world but it is their dedication for the nation that they are here. This is very good for the industry and the country as a whole. It is therefore of utmost importance that they are duly commended for their outstanding achievements — whether it is cryogenic engine or the *Kamini* reactor. We must also recognize that Science & Technology is going to be the basis of development — more so than ever before. Also science is to be sponsored not only because of its great relevance to the development — be it in the industrial sector or the agricultural sector, but it is also to be supported in term of pure knowledge. For, battles of science are today fought on the frontiers of knowledge. Expressing his happiness over the presence of Prime Minister at the function, the CSIR Vice-President said that this would provide great encouragement to our scientists and show that we all accept that technology is key to development.

Earlier, welcoming Shri Deve Gowda, Prof. Alagh and the distinguished scientists, Dr R.A. Mashelkar, Director General, CSIR, described the occasion as a red letter day for the Council, since the practice of presentation of Bhatnagar Prizes by the Prime Minister himself was being revived after a lapse of six years. This shows deep commitment of the government to Science and Technology.

Describing the awards, Dr Mashelkar said that the Shanti Swarup Bhatnagar prizes were instituted in 1957 to locate and recognize excellence in S&T. These prizes are given to scientists below the age of 45, for their research contributions made in India. So far 303 scientists have been given these prizes and many of them have become leaders of Indian science today.

The CSIR Golden Jubilee Prizes were announced, Dr Mashelkar said, during the Golden Jubilee celebrations of CSIR in 1991-92. Two prizes — one to Prof. C.N.R. Rao and the other to Prof G.N. Ramachandran — are being presented for their lifetime contributions to physical and biological sciences.

Dr Mashelkar also read out the citations of the prize-winners.

Prof. E.S. Raja Gopal, Director, NPL, proposed a vote of thanks.

Prof. G.N. Ramachandran, who is not well for quite some time, could not attend the function.

CITATIONS

CSIR Golden Jubilee Prizes

Physical Sciences — Awarded to Professor C.N.R. Rao, President, Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur Campus, Bangalore.

Professor Rao, the most noted and quoted chemist from the third world, has made seminal contributions to the development of the field of solid state chemistry. His outstanding contributions in phase transitions, surface phenomena, design of new materials, etc. have been truly path breaking. His contributions to the present-day condensed matter science, including metal insulator transitions, high temperature superconductivity and giant magnetoresistance in metal oxides have opened up new vistas. As builder of world class scientific institutions in India and as one of the architects of national science policy, Professor Rao has left an indelible mark on Indian science.

Biological Sciences — Awarded to Professor G.N. Ramachandran, formerly Professor in Indian Institute of Science, Bangalore.

Professor Ramachandran, the founder of the modern field of molecular biophysics, has made seminal contributions in the development of the theory of molecular structure of biopolymers in relation to their biological activities. The Ramachandran plot was a turning point in the evolution of the theory of biopolymer conformation and it has made major impact on all branches of biochemistry and molecular biology. His work was acclaimed as the starting point for the development of CAT scan technique in radiography and magnetic resonance imaging for this purpose. His far-reaching contributions have placed him as the most leading life scientist of India.

Shanti Swarup Bhatnagar Prizes: 1996

Mathematical Sciences — Awarded to Dr Viakalathur Shankar Sunder, Institute of Mathematical Sciences, Chennai, for his discovery of integral hypergroups which describe the fusion rules governing the irreducible bimodules coming from a subfactor in the theory of von Neumann algebras. This has led to the important conclusion that certain graphs cannot arise as principal graphs of subfactors, thereby settling a well-known conjecture of Ocneanu.

Physical Sciences — Awarded to Dr Thanu Padmanabhan, Inter-University Centre for Astronomy and Astrophysics, Pune, for his outstanding contributions in several areas of modern astrophysics and cosmology, notably in the fields of quantum gravity and structure formation in the universe. His work has provided a simple and consistent interpretation for the semiclassical limit of quantum cosmology based on the concept of decoherence. His recent work has led to a better understanding of nonlinear gravitational clustering in the formation of structure in the early universe.

Chemical Sciences — Jointly awarded to Dr Narayanan Chandrakumar, Central Leather Research Institute, Chennai and Dr Mariappan Periasamy, University of Hyderabad, Hyderabad.

Dr Chandrakumar has made significant experimental and theoretical researches in rotating frame coherence transfer and multiple NMR, high resolution spin-1 NMR and spin-1 connectivity mapping, especially in solution state, and invented a novel technique for NMR imaging and diffusion measurements.

Dr M. Periasamy has devised innovative and practical experimental procedures of synthetic interest. He has advantageously used carbon metal bonds to construct diverse types of molecular structures.

The prize-winners with Shri H.D. Deve Gowda, Prof Y.K. Alagh and Dr R.A. Mashelkar

Biological Sciences — Jointly awarded to Dr Vishweshwaraiah Prakash, Director, Central Food Technological Research Institute, Mysore and Dr Ghanshyam Swarup, Centre for Cellular and Molecular Biology, Hyderabad.

Dr V. Prakash has been awarded for his work encompassing structure-function relationship and structural homology of seed proteins bearing on ligand binding, association- dissociation and denaturation profiles of these proteins. His work has been fundamental to understanding the behaviour of a number of seed proteins and enzymes in many diverse solvents from the point of view of their stabilization and destabilization. The above work has generated an in-depth knowledge and signifies deep understanding of the structural biology of seed proteins from the biophysical angle.

Dr Swarup has made important contributions in the area of cell biology. Notably, he has discovered a novel nuclear protein tyrosine phosphatase and shown that this protein is a positive regulator of cell proliferation.

Earth Sciences — Jointly awarded to Dr Syed Wajih Ahmad Naqvi, National Institute of Oceanography, Dona Paula, Goa and Dr Shyam Sundar Rai, National Geophysical Research Institute, Hyderabad.

Dr Naqvi has made sustained and significant contributions to biogeochemical cycling in the Arabian Sea.

Dr Rai has made significant contributions to studies of the deep seismic structure of the Indian continental lithosphere and its geotectonic evolution.

Medical Sciences — Jointly awarded to Dr Vijayalakshmi Ravindranath, National Institute of Mental Health and Neurosciences, Bangalore and Dr Shiv Kumar Sarin, G.B. Pant Hospital, New Delhi.

Dr Ravindranath has carried out pioneering work on the xenobiotic metabolizing capability of the brain, with special reference to environmental toxins and psychoactive drugs.

Dr Sarin has carried out original extensive work, clinical and experimental, in the field of liver diseases, especially portal hypertension. □

CFRI completes Fifty Years

Symposium on Science, Technology, Industry, Business and Environment relating to Coal – 'Coal-96'

With successful completion of the two-day International Symposium on 'Science, Technology, Industry, Business and Environment relating to Coal' (Coal-96) on 18-19 November 1996, the Central Fuel Research Institute (CFRI), Dhanbad, concluded its year-long Golden Jubilee celebrations.

The symposium was inaugurated by Dr S.K. Gupta, Chairman, Research Council of CFRI, in the absence of Shri P.K. Sengupta, Chairman, Coal India Ltd. Dr Gary E. Staats, Resident Representative of the Department of Energy, USA, was the Chief Guest.

In his address, Dr S.K. Gupta lauded the contribution made by CFRI in the energy sector. He said that after opening up of the economy in the world of global competitiveness. CFRI was the first among the CSIR laboratories to make a strategic plan with a vision for the year 2000, with the participation of a large section of the scientists and staff of the institute. Also, sustained efforts for attaining higher efficiency and quality in research enabled the institute to earn ISO-9001 certification, which was also the first among CSIR laboratories. According to him, the seven monographs relating to various aspects of coal utilization published as a part of the activities of Golden Jubilee will be regarded as perpetual source of knowledge in the years to come.

Dr Gary E. Staats in his address congratulated CFRI for the completion of fifty successful years and spoke about the involvement of USA in the energy sector in India. According to him, coal will continue to be the basic source of energy even in the next century, and there are distinct reasons to develop environment-friendly technologies. At present, US Energy Department is working in India on a 90 million dollars 'Green House Project', advanced biogas generation for electricity, and providing experts assistance to NTPC for improving power plant efficiency.

In his inaugural speech which was read *in absentia* by Shri C.K.V.N. Rao, Director (Technical), Shri P.K. Sengupta, Chairman, Coal India Ltd, expressed his appreciation for the high standard of services rendered by CFRI to the coal industry during its existence as a premier organization dedicated to the research and development in coal and related fields. Shri Sen Gupta said that the 'Working Group on Coal and Lignite' set up by the Planning Commission has assessed India's coal demand to grow to 440 million tonnes by the year 2001-02; and to 580 million tonnes by the year 2006-07, which means that in the next ten years the coal production has to be doubled from the present level of 290 million tonnes. This is going to be a tremendous task for the coal producing companies. For enhancing the utilization avenues of coal, greater thrust has to be given to R&D activities in coal related fields. For making these activities more meaningful, the interaction between the R&D organizations and the industries has to be closer. Shri Sen Gupta expressed the hope that CFRI will continue to lead in those directions.

In his welcome address Dr K.S. Narasimhan, Director, CFRI, said that CFRI has played a major role in the last five decades in establishing 200 billion tonnes of coal reserves, generation of process know-how for the 22 operating coal washeries having a total capacity for processing 36 million tonnes of coal, in developing beehive coke ovens for supply of coke to iron and steel industry and processing coal tar for producing chemicals. In the present economic and global situation, CFRI has oriented its activities also towards energy conservation, utilization and environment.

In the two-day deliberations about 45 papers were presented in the technical sessions on Coal Science, Advanced Coal Preparation, Environment, Coal Chemicals, and Advanced Coal Utilization.

The valedictory function was held on 19 November with Dr M. R. Srinivasan, Member Planning Commission, as the Chief Guest.

In his address, Dr Srinivasan said that the Golden Jubilee of any institution is an important landmark. Fifty years is a long time for an institution, and it is time to take stock of its accomplishments and also to look to the new direction for the future. He said that coal in many ways is a mother substance. It is not just a fuel but a source of large number of organic chemicals, and coal derivatives play an important role in pharmaceuticals, dyes and other products.

In India, roughly 37% of the primary energy is still produced through non-commercial fuel routes, i.e. firewood, agricultural refuses, cowdung and so forth and the rest from the commercial fuel that is coal, petroleum, gas, etc. Coal dominates the commercial sources. The use of liquid fuels and gas is certainly increasing but coal remains the most important primary source of fuel in our economy.

Some time back, we switched from privately run coal and oil business to nationalized coal and oil business. At that time these decisions appeared to be right because substantial increase in production of coal and oil took place within the country and in off-shore areas. It happened in a rather rapid manner and production rates of both coal and hydrocarbons increased to a great deal. But over the years, the policy administered prices have created serious distortions and the impact of cross subsidization in many of the energy-related areas has resulted in difficult problems that we are now required to resolve. Of course, in the case of coal and oil, the major concern is how to re-regulate these sectors and market forces to play much stronger role than in the past.

Speaking about the energy production in the country, Dr Srinivasan said that the electricity sector is the most important single sector using coal, followed by the steel sector. The future expansion also foresees the continuing importance of coal. Of course, we have to revive the hydroelectric option which initially was being pursued rather actively. But in the last 5-10 years, the pace of increasing additional hydroelectric capacity has slackened. This has happened mainly because of the ecological and ground submergence factors and also displacement of people from the affected areas. According to him, use of lower height dams or run away river schemes for pursuation of the hydroelectric option should be given more emphasis, because it is found to be quite impossible to push the coal to consuming centres located in far away areas from mines. The expansion plans for electricity generation also foresee use of imported coal at some of the coastal locations. The need to import liquid natural gas is also foreseen. It was thought to get gas from Iran through pipeline passing from Pakistan and also from the Middle-East, through undersea pipeline. But now it is felt that the undersea pipeline project is not economical because of the great depth to which the pipes have to be laid and the Iran-India pipeline through Pakistan has not made much progress because of the strained relationship with that country. So, the electricity sector will continue to depend on coal, largely using pit-head stations, some imported coal fired stations, some hydrocarbon stations and so on. Also, we will have to continue to work on atomic nuclear power stations and the non-conventional energy sources, India generates about 800 MW wind power, which is expected to go up to 1000 MW in the next year. It is planned to take the wind and solar power generation from about a 1000 MW next year to 3000 MW in about five years' time. Of course, this is still going to be a very small supplement. Our total electricity generation capacity is estimated to about 83,000 MW in the next five years and possibly another 50,000 MW in the following five years. So there will be a very large increase in electricity capacity, a good part of which will be based on coal.

After this, Dr Srinivasan dealt with the question of coal and environment. According to him the only possible option is to pursue higher efficiency technologies so that the carbon dioxide emission per unit can be minimized. For this we must look at the induction of integrated coal gasification route, pressurized fluidized bed combustion, and use of super critical cycles, etc. for the power stations. An important point is that we have to increase the efficiency of fuel use in the wider sense. At present, our steel plants are using much more energy per unit of steel and iron produced than that elsewhere in the world. Same is the case with the cement industry. This has happened because there has not been a market push to achieve higher efficiency. In the electricity sector, it is so because of the unreal prices. The push towards efficiency has not moved the way it should have, and expenditure on R&D has actually fallen in the last few years. We must ensure, Dr Srinivasan said, that we carry out R&D on a much larger scale than what happened in the last few years. We must also ensure that private sector carries its due share of R&D. It must be realized that a large section of our private sector in the last several decades was in the fortunate position of having sellers' market with no competition to face. Therefore there was no compulsion to spend money on R&D. Also, certain section of our industry is linked to overseas industries who look for putting the technology elsewhere. Both these factors have tended to be negative forces, retarding penetration of R&D in our industrial activities. How to integrate our science and technology capabilities with industry is a big question. In some areas this has happened reasonably well, like in agriculture, in atomic energy and in space. The linkages have been strong and the results also have been quite good. The question now is how do we establish this integration in the larger areas of industry and business.

The Council of Scientific & Industrial Research in its new Vision envisages earning much more money through contracts, consultancy and patents. To achieve this, it will be necessary to transform some scientists into businessmen and managers while rest of them of course will have to continue their excellence in science. Both these inputs are very important. He urged to create conditions for innovation, for creativity, for non-hierarchial management style. This is extremely important. The really creative people are the young entrants to the scientific community and if they get frustrated they would probably move into management positions or to other areas, and the research institutions will not be able to have the creative scientists. It is also important to have mobility between industries and laboratories. This has not happened at all in the past. Dr Srinivasan suggested that the activities have to be prioritized and focussed and therefore areas of strength have to be picked up. Networking between the countries, between the institutions is also very important, he added.

Dr Srinivasan also inaugurated the *Nalanda Gate* — the Golden Jubilee Entrance to CFRI.

Dr R.A. Mashelkar, Director General, CSIR, could not attend the symposium owing to an urgent meeting with the Prime Minister. His message was read out by Shri S.D. Garg, Adviser, CSIR. Congratulating CFRI on his own behalf and on behalf of the entire CSIR family, Dr Mashelkar said, "CFRI's impressive contribution to the country's crucial energy sector during the past 50 years has been recognized by everyone. In particular, CFRI's contribution in regard to Indian coal for meeting the domestic industrial and energy needs and its providing a wide and effective knowledgebase in all areas of utilization of Indian coals are appreciated by one and all. CFRI's work on coal beneficiation leading to defining washability index of coal and establishment of a method of economic beneficiation of coal and rational designing of coal washeries has global value. Indeed CFRI can look back on several areas in which it has made an impact, be it combustion, carbonization, gasification or blending prescription of steel plant coke ovens with great deal of satisfaction and pride. The challenges of the future are there for everyone to see and for which CFRI is gearing up quickly. By securing ISO 9001 Certificate, CFRI became the first CSIR laboratory to instil the sense of confidence and quality assurance to the industry. CSIR has already come out with the *CSIR 2001 Vision* strategy. I was delighted to see that CFRI was quick in its action to gear up to the demands to fulfil the CSIR vision and promptly announced the *CFRI 2001 Vision and Strategy* matching so well with the CSIR vision. In fact, CFRI is amongst one of the first few CSIR laboratories to announce this vision scheme. I am sure that with the enlightened leadership and dedicated work force CFRI will attain greater heights of excellence to meet the future R&D challenges of the energy sector."

Quoting from Pandit Jawaharlal Nehru's speech given during his visit to CFRI in 1952, Dr Mashelkar expressed the hope that the great adventure of science and technology will inspire and motivate all of us to rededicate ourselves to S&T human welfare at large.

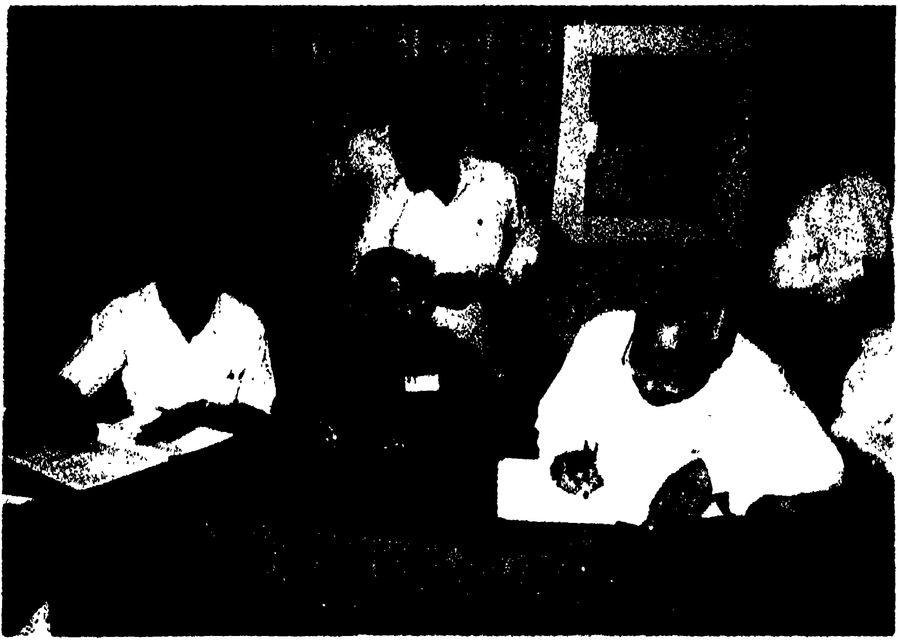
Outlining the points which came as basic output of the two-day symposium, Dr S.K. Gupta, Chairman, CFRI Research Council, pointed out that everyone agrees that in the global market situation, it is necessary and desirable to network R&D activities between nation to nation. Institution to institution. He emphasized that the presence of experts from seven leading countries showed keenness for collaboration and network development, the output of which to be shared by the industry, independent of whichever country it belonged. Referring to the policies followed in Australia, he said that five cent per tonne of coal mined in that country is put as R&D fund by the Government which suitably contracts the institutions dealing with R&D and provides them this fund to ensure long-term developmental activities. He suggested that similar system could be introduced in India also. He pointed out that Australia is a market-oriented, market-led country. That in Australia, where the wage of coal mining professionals is 15 times that of the coal mining professionals in India;

Cadbury Schweppes signs MoU with NEERI

M/s Cadbury Schweppes Beverages India Pvt. Ltd (CSBIL), Mumbai, have entered into a Memorandum of Understanding with the National Environmental Engineering Research Institute (NEERI), Nagpur, on 14 January 1997, for delineation of environment strategy and management policy in line with CSBIL's international guidelines; environmental impact and risk assessment of CSBIL facilities and its bottlers; liquid waste management with focus on recycle/reuse through environment-friendly technologies; product quality monitoring at the national level for soft drink and bottled water; conservation and management of energy resources; and total environmental quality management. ❑

CLRI & NEERI sign agreement with AISHTMA

THE Central Leather Research Institute (CLRI), Chennai and the National Environmental Engineering Research Institute (NEERI), Nagpur, have signed an agreement with The All India Skin and Hide Tanners and Merchants Association (AISHTMA), Chennai, on 1 January 1997 to undertake studies on inplant measures and waste water management in clusters of tanneries in Tamil Nadu. The R&D, to be completed in two phases over a period of twelve months, involves delineations of inplant measures, and measures for improvement in the performance of the CETPs under operation, and construction. The measures so delineated will be implemented by AISHTMA to ensure economy in production and compliance with the MEF and TNPCB Effluent Standards. The total fees payable by AISHTMA to CLRI and NEERI for the assignment is Rs 60 million. ❑



Signing of agreement between The All India Skin & Hide Tanners and Merchants Association, Chennai and CLRI & NEERI

R&D support system could be organized leading to the development and establishment of technologies and that the country could export coal to the Indian shore shows what technology adoption can achieve.

It was suggested that long-term investment is required for mining the lower seam of Jharia coalfield located at greater depths, which is regarded as one of the best coking coals in the world, whose beneficiation properties are also favourable. Unless long-term investment is made, there will only be short- term gain.

It was observed that all over the world the governments maintain a distance from the business. But in spite of this, particularly in countries like USA, Australia and South Africa, it is accepted that in the area of coal, direct and indirect support from government is essential and is being provided.

Next important point that emerged from the deliberations is that CFRI should emphasize more on the activities pertaining to environmental audit, technologies for rural development and waste recycling/utilization. An important outcome of its research activities relates to the use of bacteria. If bacteria could be harnessed to enrich coal-based materials, the clubbing of this technology with others would lead to the development of multiple objective technologies. This area should therefore be given due importance.

It was pointed out that the demand of coal in India has always been more than the supply. As a result customers have no say. It was suggested that the mining of coal should maximize, exceeding the domestic demand and a part of this should be exported at least to the neighbouring countries, e.g. Thailand, Nepal, Bhutan and Sri Lanka. If the demand-supply system gets changed, the basic quality and cost consciousness regarding coal will improve. Incidentally, after the liberalization, when the threat of integrated steel plant coming to the private sector became visible and, in fact started happening during the last four years, the performance of Steel Authority and TISCO witnessed an improvement of 8-10% in terms of productivity, fuel rate, yield, quality, etc. So, if in coal sector also the demand becomes less than the supply and demonopolization takes place to a great extent, then there is no reason why coal cannot continue to be the major energy source. Particularly, when there is unanimity in support of coal to continue to be the major energy source not only in India but practically throughout the entire planet.

Speaking on the occasion, Dr K.S. Narasimhan informed that the institute has succeeded in bringing out a demo CD interactive condensed disk on Jharia Coalfield, which will be immensely helpful to industry, coal consumers and researchers. He also announced the names of winners of the CFRI Golden Jubilee Awards. The recipients under the various categories are: *Technology Development* -- Dr Kalyan Sen for providing design and consultancy in setting up mini flotation plants and Dr Gulab Singh for establishing benefits of fly ash in agricultural use; *R&D Support* -- Dr S.K. Hazra for business development relating to coke oven, Shri Samir Sen for his efforts towards the publication activity and Shri A.K. Roy for design and fabrication of an apparatus for BHEL; *Technical Services* -- Shri R.A. Rai; and *Administration*-- Shri Amalendu Ghose, Shri S.P.Mishra and Shri M.P. Singh. The awards carried a cash prize of Rs 20,000 for each category. ❑

Institute - Industry Meet on Metal Matrix Composites

THE second 'Institute-industry meet on Metal Matrix Composites' (MMC) was organized by the Regional Research Laboratory (RRL), Thiruvananthapuram, at the Indian Institute of Science, (IISc), Bangalore, in collaboration with M/s Hindustan Aeronautics Limited (HAL), Bangalore, and Department of Metallurgy, IISc, on 17 December 1996. Main objectives of this meet were to bring together both MMC researchers and potential users/industries to discuss the current status of MMC development and application in the country vis-a-vis abroad, identify the problems in procuring and product development as well as chalk out remedial measures to overcome the problems and march forward in the field of indigenous MMC development/application. Twenty-five participants attended the meet which included two foreign visitors, 15 user-industry personnel and the rest from R&D and academic institutions. User-industry participants included TVS Group, HAL, ISRO, Defence and foundries. R&D-academic group included CSIR Labs (RRL-Thiruvananthapuram, Bhopal), DMRL and IISc.

Dr C.G. Krishna Das Nair, Managing Director, HAL, Bangalore Complex, in his opening remarks informed about the growing importance of MMC in the international scene and stressed the need for collaborative ventures in the country to be at par with that abroad. He hoped that this type of meets would fulfil such needs.

Dr K.G. Satyanarayana, Convener of the meet, gave an overview of MMC, its importance, international scenario, particularly with respect to large-scale production (6.5 tonnes/batch), non-availability of the technology for import, prototype fabrication of various components particularly for the automotive sector, US/European/Japanese ventures in these, cost consideration, etc. He also presented a brief account of the scenario prevailing in India.

Later, user industry participants made brief presentations on their interest in MMC, initiatives taken by them, problems encountered, and sought the intervention/collaboration with the R&D institutes /academia, to forge ahead.

Representatives from R&D institutions and academia made presentations on their activities, capabilities, and facilities available in their institutions in the area of MMC and called upon the user-industries to make use of these for their betterment. They also assured to look into the problems and help the industries to overcome the same.

Some of the important aspects discussed at the meet related to increasing R&D Institutes-Industries interaction, identification of components for automotive/aerospace application, component development through corporative work including characterization of components by R&D Group; Need for large-scale production of MMC by both P/M and casting to establish techno-economic feasibility and centralized testing facility and databank for MMC.

Participants of Second Institute-Industry Meet on Metal Matrix Composites

It was decided to bring out the proceedings of the meet for the benefit of user-industries in the country. ❑

SEMINARS

Modern Aspects of Electrochemistry

FOLLOWING the two seminars held successfully in 1991 (in India) and 1993 (in Germany), the third Indo-German Seminar on 'Modern Aspects of Electrochemistry' was organized at the Indian Institute of Science (IISc), Bangalore, last year, to review the latest developments, exchange ideas and foster R & D collaboration between the two countries. This seminar, sponsored by DFG, Bonn and Indian National Science Academy, New Delhi, was organized and supported by twelve institutions in the country, including the Central Electrochemical Research Institute (CECRI), Karaikudi, and National Aerospace Laboratories (NAL), Bangalore. Eminent scientists from both countries (11 from Germany and 20 from India) delivered invited lectures covering the latest developments, and projecting the future prospects of the area of electrochemistry. Besides, 36 technical papers were presented by scientists from leading research groups in India, in posters. The seminar was attended by around a hundred working scientists and academia.

The inaugural function was chaired by Prof. K.I. Vasu, Chairman, SAEST Bangalore Chapter; Prof. G.V. Subba Rao, Director, CECRI, welcomed the gathering while Prof. R. Schollhorn, Tech. Univ., Berlin and leader of the German delegation introduced delegates from his country to the audience. Prof. G. Padmanabhan, Director, IISc, inaugurated the symposium. He stressed the importance of the role of Electrochemistry in different disciplines. Dr Ch. Krishnamurthy Rao, President, SAEST and Chairman, Chem Fab Group, Chennai, offered felicitation for the conference, followed by another felicitation by Dr M. Ravindranath, President, Electrochem. Soc. of India, Bangalore. Dr (Smt) Indira Rajagopal, NAL, proposed a vote of thanks.

The first technical session focussed on Fundamental Electrochemistry. The session, jointly chaired by Dr D. Rahner of Techn. Univ. Dresden, Dresden and Prof. E. Dwarakadasa of IISc, featured five lectures. Dr Rohwerder of Max-Planck Institut für Eisen Forschung, Dusseldorf, highlighted the role of scanning tunneling microscopy in understanding the characteristics of organic monolayers on electrodes. This was followed by a talk dwelling on the theoretical perspectives of electrochemistry by Prof. S.K. Rangarajan of Inst. Mathemat. Sci., Chennai. In a talk on electroanalytical techniques, Prof. S. Jayarama Reddy of S.V. University, Tirupati, reviewed the scope and utility of abrasive stripping voltametry. The mechanism of topotactic electrode reactions was the subject of the lecture by Prof. R. Schollhorn who proposed an alternative electrochemical route to the conventional thermal synthesis for tailoring solids and their physical properties. The session concluded with a lecture on metal hexacyanaferrate-modified electrodes and their potentialities in analysis and devices by Dr G. Prabhakara Rao of CECRI.

The second session focussed on materials. It was chaired jointly by Prof. S.K. Rangarajan, Inst. of Mathemat. Sci., Chennai and Prof. K. Sartori of Univ. of Duisberg, Duisberg. The session opened with a talk on fullerenes by Prof. L. Dunsch of Institut für Festkorper und Werkstofforschung, Dresden, who explained the derivatization of fullerenes with conducting polymers and their electrochemical characterization. Dr A. Zielonka of Forschungs Institut für Edelmetalle und Metallchemie Schwabisch-Gmund, described multilayer plating through pulse techniques and enhancement of wear resistance of gold electroplates by incorporation of TiN and diamond. This was followed by a talk by Prof. K. Juttner of DECHEMA, Frankfurt, who highlighted the use of ionic conductivity of polypyrrole for permaselectivity applications.

The focal theme of the third technical session was Chemicals. It was chaired by Prof. K. Juttner and co-chaired by Prof. K.S.V. Santhanam of TIFR, Mumbai. The session began with a lecture by Prof. K. Sartori who illustrated the electrochemical synthetic strategies for the production of perfluorinated organic compounds. Following this, Prof. K.K. Balasubramanian. IIT, Chennai, demonstrated the uniqueness of electrochemical approach for synthesizing o-allyl and o-allenyl phenols. Mineral processing using the bioelectrochemical route was nicely explained by Prof. K.A. Natarajan (IISc).

The fourth session was on Metal Finishing. It was chaired jointly by Dr Zielonka and Dr S. John (CECRI). In this session, Dr (Smt) Indira Rajagopal of NAL elaborated the R & D efforts of her group in surface engineering, to achieve the development of sunshield panels for INSAT. This was followed by a presentation on the use of electroplating technology for the material development by Dr M.K. Totlani of BARC, Mumbai.

The fifth session was on 'Energy'. It was chaired by Prof. J. Heinz, Freiburg Univ., Freiburg and co-chaired by Prof. G.V. Subba Rao (CECRI). The session started with a talk on UPD catalysis of fast redox reactions for electrochemical energy storage systems by Prof. R. Holze of Tech. Univ. Chemnitz. Following this, Prof. A.K. Shukla of IISc highlighted the role of platinum loaded electrocatalysts for the direct methanol fuel cells development. Dr P. Sridhar of SPIC Science Foundation, Chennai, elaborated on their developmental efforts on polymer electrolyte membrane fuel cells.

'Corrosion' was the theme for the sixth and final technical session which was chaired jointly by Dr M. Rohwerder and Dr M.K. Totlani. The seminar opened with a lecture on the methods of corrosion rate determination for metals and alloys with corrosion films/corrosion products by Shri J.B. Gnanamoorthy of the Indira Gandhi Centre for Atomic Research, Kalpakkam. This was followed by a talk by Dr M.B. Deshmukh of Naval Materials Research Laboratory, Mumbai, who explained the managing of the electrochemical breakdown of passivity, especially with reference to marine alloys. The session concluded with a lecture by Prof. U.K. Chatterjee of IIT, Kharagpur, who discussed the role of electrochemical and electrostatic parameters on stress corrosion cracking of materials.

An interesting feature of this seminar was a Microsymposium on Newer Electrode Materials and discussion sessions on Conducting Polymers and Electrochemical Sensors, that were sandwiched between the technical sessions.

The Microsymposium on Newer Electrode Materials was chaired jointly by Prof. R. Schollhorn and Dr S.R. Rajagopalan. The inaugural talk was delivered by Dr (Smt) Indira Rajagopal. Dr D. Rahner gave a lecture on electrochemical properties of complex oxide materials and their dispersions for applications in energy conversion and corrosion protection. In another lecture, Prof. M. Wohlfahrt-Mehrens of the Centre for Solar Energy and Hydrogen Research, Ulm, reviewed several different types of doping of nickel hydroxide and explained the charge/discharge mechanism of $Ni(OH)_2/NiOOH$ electrode. The microsymposium concluded with a presentation on characterization of electroless nickel by Dr (Smt) K.S. Rajam of NAL.

The first discussion session on Conducting Polymers was co-chaired by Prof. U. Guth of University of Greifswald and Prof. S.V. Subramanian of IISc. The session began with an illuminating talk on advances in conducting polymer research by Prof. K.S.V. Santhanam. This was followed by a lecture by Prof. J. Heinze who introduced the oligomeric approach in growing conducting polymer films by electropolymerization. Prof. S.V. Subramanian gave a talk on carbon film synthesis and pressure induced conductivity studies of polypyrrole. This was followed by a lecture by Dr D.C. Trivedi (CECRI) who spoke on the influence of anions on the polyaniline synthesis. Dr D. Abraham (IISc) concluded the session with a presentation on methods of making polyaniline blends.

Prof. G. Padmanabhan, Director, Indian Institute of Science, Bangalore, delivering the inaugural address at the third Indo-German Seminar on Modern Aspects of Electrochemistry

The second discussion session on Electrochemical Sensors was chaired jointly by Dr Wohlfahrt-Mehrens and Dr G. Prabhakara Rao.

In this session Prof. U. Guth highlighted the recent research on electrochemical gas sensors using solid electrolytes, with emphasis on the carbon dioxide sensor. Dr C.K. Mathews (formerly at IGCAR, Kalpakkam) reviewed the electrochemical gas sensors relevant to nuclear reactor research. The session ended with a presentation by Dr V. Sundaram of CECRI, on recent trends in solid state sensor materials for carbon dioxide sensor.

Another salient feature of this meet was the organization of poster session in which 36 research papers on current activities in Electrochemistry from CECRI, IIT (Chennai); Chennai University; IIT (Mumbai); TIFR; NCL (Pune); Pondicherry Univ.; BARC; S.V. Univ (Tirupati); IGCAR; HEB (Mathur), NAL and Bangalore University were presented. The poster session, spread over two days, provided one-to-one discussions among the delegates.

On the concluding day there was a Panel Discussion which included response from the delegates with respect to future course of action. It was decided to lay emphasis, as part of the collaborative efforts, on portable and rechargeable power sources including fuel cells, development of eco-friendly technologies, pollution abatement through electrochemical route and development of materials for sensors for obnoxious gases and toxic ions.

Dr Rajendra Prasad, Coordinator of Indo-German S&T Cooperation at CSIR, New Delhi, presented an overview of the existing collaborative efforts between the two countries and pointed out various avenues available, not only through CSIR but also through Department of Science & Technology, Indian National Science Academy and University Grants Commission. He also pointed out that applied aspects of research, preferably in collaboration with Indian and German industries, will be given preference for both short-term and long term collaboration.

It was decided to bring out the proceedings in a book form.

The fourth Indo-German Seminar will be held during 1999 in Germany. ❑

WORKSHOPS

Water Quality Instruments

A National Workshop on Water Quality Instruments was organized at the Central Scientific Instruments Organisation (CSIO), Chandigarh, on 26-27 November 1996, at the instance of the National Drinking Water Mission. The main purpose of this workshop was to assess the suitability/efficiency of water quality monitoring instruments manufactured in the country. The various agencies were informed while inviting them for participation that they could have their instruments evaluated by an Expert Committee as per the prescribed standards.

Welcoming the participants, Dr K.R. Sharma, Director, CSIO, brought out the importance of holding such a workshop. Inaugurating the workshop, Shri S.D. Garg, Adviser, CSIR Missions Programme, told about the role CSIR has been playing in the implementation of Mission Programmes, especially in providing potable water to the masses. Dr Krishan Lal, Director's Grade Scientist & Head, Material Characterization Division, National Physical Laboratory, New Delhi, delivered a lecture on Reference Materials with special reference to Water Quality Instruments. He also inaugurated an exhibition of the instruments put up by the participating agencies. It gave a live demonstration of the indigenous and some imported instruments.

The Expert Committee comprising Dr Krishan Lal; Dr S.P. Pande, Scientist (NEERI); and Shri A.K. Ganju, Scientist (CSIO), evaluated the performance of the indigenous instruments in accordance with the standards prepared by NPL/CSIO. The committee was assisted by a technical team comprising Shri M.L. Singla, Shri B.R. Kakkar, Shri Mewa Singh, Shri S.S. Randhawa, Dr Wajid Ali, Smt. Sangeeta Garg and Smt. Laxmi Pandey from CSIO, and Dr A.K. Agrawal from NPL. It observed that no company has developed a complete water analysis kit which could determine all the parameters of Water Quality as per the WHO specifications. Different units have been developed for different parameters. ITRC, Lucknow has also developed a kit. However, the committee proposed that an integrated water analysis kit, encompassing all the parameters of water testing, should be developed jointly by NPL and CSIO in association with an entrepreneur. ITRC and NEERI may also be associated with this project. It also recommended that another workshop on Water Quality Instruments be conducted wherein the entrepreneurs and users could interact. ❑

Intellectual Property Rights

Shri N.R. Subbaram's Lecture at NAL

SHRI N.R. Subbaram, Adviser (Patents), CSIR, delivered a lecture on 'Intellectual Property Rights' at the National Aerospace Laboratories, Bangalore, on 8 October 1996. The lecture included basic definitions ("A patent is a legal right conferred by the state to an applicant/inventor for disclosing an invention to make use and or sell the invention for a limited period"); information ("Out of the 30 million patents worldwide only about 4% have been commercialized"; and "Nearly 90% of all patents relate to databases."); and advice ("make sure you regularly scan patent databases — patents are not only for protection, they also contain the best information on contemporary technologies"; "Patent first and publish later — otherwise your technological novelty is lost!" ; and "Disclosing technical information in a patent is a fine art — you must know what to disclose and what not to disclose!"). Shri Subbaram also answered several keen questions put up by the audience, e.g. What is the difference between a patent, copyright and trademark? Can software be patented? If not, how can it be protected? What's the difference between a product and process patent? How can we protect innovative ideas? What are the sources of patent information? Why are patents so important? ❑

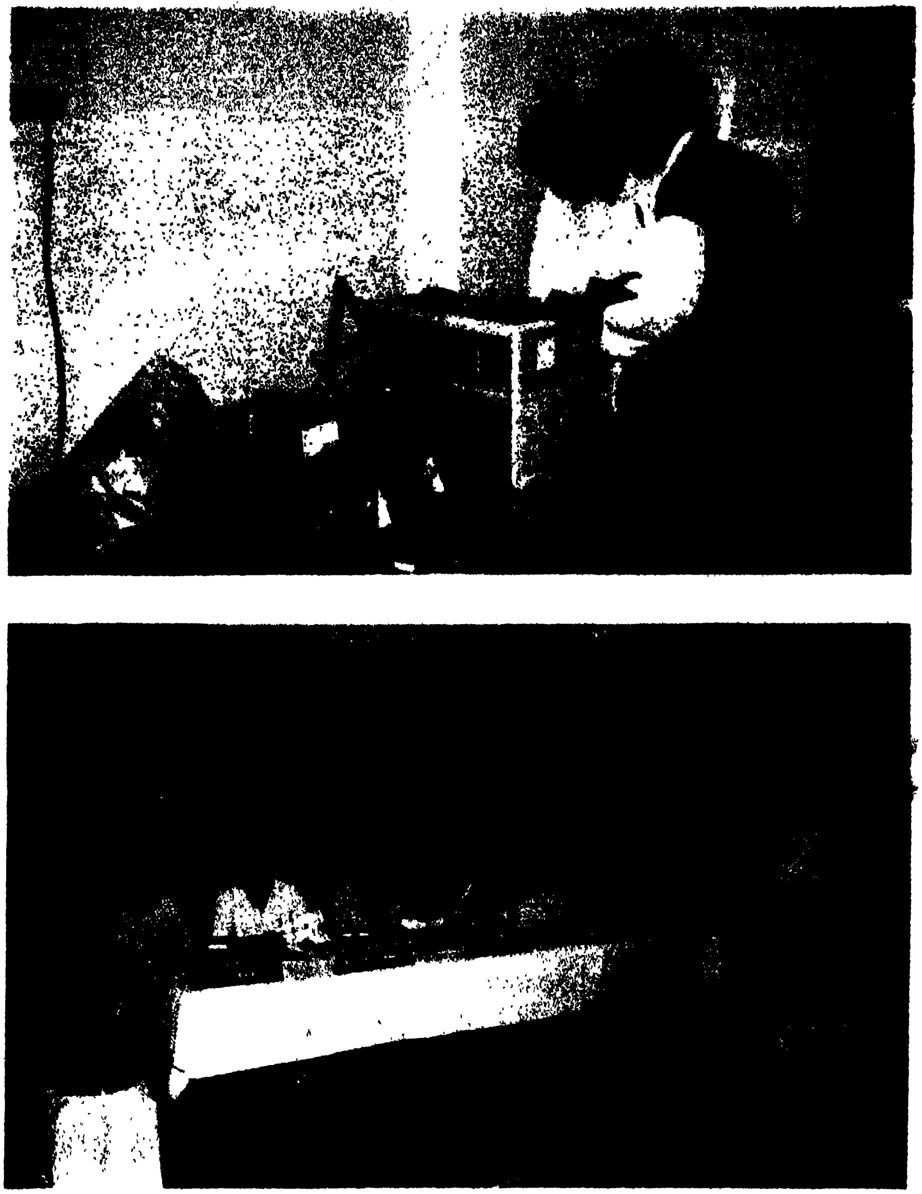
TRAINING PROGRAMMES

Repair & Maintenance of Bio-medical Instruments

AN eight-week entrepreneurship development programme on Repair & Maintenance of Bio-medical Equipment was recently conducted by the Centre for Entrepreneurship Development, Madhya Pradesh, Bhopal; Central Scientific Instruments Organisation (CSIO), Chandigarh; and the Regional Research Laboratory (RRL), Bhopal, at RRL-Bhopal.

The programme was sponsored by the National Science and Technology Entrepreneurship Development Board (NSTEDB), New Delhi. Optel and Hamidia Hospital extended technical and instrumental help.

Twenty-five fresh engineering degree/diploma holders from Madhya Pradesh participated in this programme.



Entrepreneurship Development Programme on Bio-medical Equipment — inaugural and hands-on sessions

Shri P.K. Jain, Dean, Gandhi Medical College, was Chief Guest at the inaugural function. In his address, Dr K.R. Sarma, Director, CSIO, informed that similar programmes will be organized at Chennai, Bhubaneswar, Bangalore, Guwahati and other places.

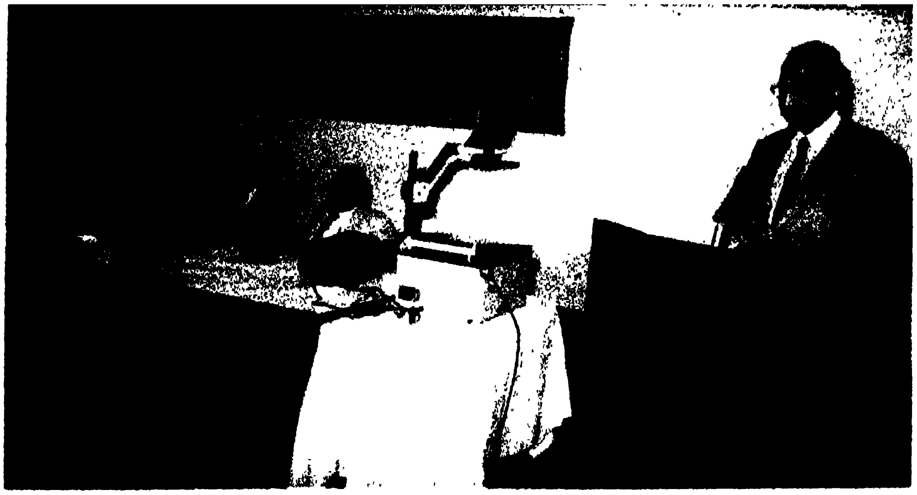
Speaking on the occasion, Dr P.K.B. Menon, Director, NSTEDB, opined that in near future, the service sector would be much ahead of the industrial sector, and require much more trained manpower.

Prof. T.C. Rao, Director, RRL, Bhopal, lauded the work of the various organizations working towards human resource development in the area of instrumentation repair/maintenance.

Shri P.N. Thakur, Health Minister, M.P., was Chief Guest at the valedictory function. In his address he called for the pursuance of a rigorous entrepreneurship development programme for generating self-employment for the young engineers, and helping hospitals in maintaining their instruments/equipment.

The programme was conducted by Shri K.K.S. Gautam, Scientist, RRL, Bhopal, in association with Shri A. Shrivastava, CEDMAP, Bhopal. ❑

Underground Storage of Oil, LPG and Other Petroleum Products



Dr R.K. Bhandari, Head, International S&T Affairs Directorate, CSIR, inaugurating the training course on Underground Storage of Oil, LPG and Other Petroleum Products

THE Roorkee Regional Centre of the Central Mining Research Institute (CMRI) organized a four-day national course on 'Underground Storage of Oil, LPG and other Petroleum Products', at Mussoorie, in the recent past.

Inaugurating the course, Dr R.K. Bhandari, Head, International S&T Affairs Directorate of CSIR, emphasized the need for developing underground storage facilities for oil, LPG and other petroleum products. Dr S.C. Maudgal, Adviser, MOEF, presided, Prof. Bharat B. Dhar, Director, CMRI, highlighted the capabilities developed by CMRI in the field of underground storage of oil, LPG and other petroleum products. Dr A.K. Dube, Scientist-in-charge of the CMRI Regional Centre, and Coordinator of the course, spoke about the objective of the programme and Dr R.K. Goel, Jt. Coordinator of the course, proposed a vote of thanks.

Attended by 22 executives from various companies like ONGC, IOCL, BPCL, IBP, GAIL, HPCL, NTPC and OCC, the course discussed: national and international status of underground storage and need for underground storage in Indian context; underground storage technology; site investigation and characterization; planning and design; construction and construction management; petroleum safety; environmental issues; effect of time on quality; sludge and sludge management, and financial aspects.

The four-day programme brought out the necessity for creating underground storage facilities for crude oil and products, to meet operational and strategic needs in the country. For this it is important to identify, possible geo-feasible locations for underground storage of crude oil and products including already proposed sites; evolve a time frame to achieve the basic concept of this national need together with budget estimates; identify the agency which will support the extension of the basic initial work already done by CMRI in this regard and suggest possible technological tie-ups for achieving such a goal. To meet the medium and long-term goals, it was emphasized that a National Task Force should be constituted at the level of Ministry of Petroleum and Natural Gas together with CMRI and concerned oil industry, so that at least one underground storage facility having an estimated capacity in the range of about one to two lakh kilolitres is created by the end of the Ninth Plan period. ❑

NEW PUBLICATIONS

Enzymes Everywhere

ALMOST everyone comes to know about enzymes during their schooldays while learning about the process of digestion. However, only a few 'non-scientific' professionals remain aware of their importance once formal education is over.

The occurrence of enzymes has been known for centuries, but the field of enzymes has seen a revolution only in the last 50 years or so with technological developments in diversified areas like fermentation, separation techniques, genetic engineering, immobilization and bioreactors. Distinguished by their versatility and efficiency, enzymes are catalysts *par excellence*. Their qualities make them profitable choice for industrial use in fields as far ranging as breweries, leather, medicine, detergents, dairy, and scientific research. Even the domestic kitchen is an arena where enzyme action comes into play. The enzymes are isolated from exotic life-forms inhabiting a bewildering variety of habitats—from volcanic vents to depths of the deep sea, no part of the earth is too hot, too cold, too

acidic or too alkaline for lifeforms to find conditions too harsh to survive.

Extensively illustrated and lucidly detailed, *Enzymes Everywhere* is the nineteenth publication under the 'CSIR Golden Jubilee Series' being brought out by the National Institute of Science Communication (NISCOM), New Delhi.

Author: J.G. Shewale, Pp 87, Price Rs 30.00 (Paperback) ❑

Honours & Awards

Dr B.S. Srivastava

DR Brahm S. Srivastava of the Central Drug Research Institute, Lucknow, has been elected Fellow of the American Academy of Microbiology, in recognition of his contribution to research of "excellence, originality and creativity" in microbiological sciences.

Dr Srivastava's significant contributions are on pathogenesis, toxin biosynthesis and molecular genetics of enteropathogenic *Vibrio cholerae*; suppression of toxin biosynthesis by endogenous plasmids and the role of plasmid borne genes in regulation of toxin biosynthesis and attenuation of virulence; the discovery of an elegant gene transfer system and the first use of RP4::mini-Mu for *in vivo* cloning of genes in *V. cholerae* and on adherence mechanism of *V. cholerae* to intestine; and characterization of two novel colonizing antigenes which have important relevance in cholera vaccine development.

Dr Srivastava's current research interests are directed towards *Mycobacterium tuberculosis* covering molecular approaches to diagnosis, screening of new drugs, transposition and expression of heterologous genes.

The other significant awards/ honours earlier received by Dr Srivastava are: S.S. Bhatnagar Prize, 1984; Dr Nitya Anand Endowment Lecture, 1991; Fellowship of the National Academy of Sciences, India, 1991; Dr Y.S. Narayana Rao Oration Award, 1993; Shri Om Prakash Bhasin Award, 1995.

Dr Srivastava has served on several National Scientific Advisory Committees, and also as a member of the Indian delegations on Biotechnology and Vaccine Action Programme, and academic societies in India and abroad. He has served as a lecturer in School of Basic Sciences at Udaipur University, Scientist at NEERI and Professor of Biotechnology at Jawaharlal Nehru University, New Delhi. Presently he is Scientist F and Head of the Division of Microbiology at CDRI.

Dr (Smt.) Kaiser Jamil

DR (Smt.) Kaiser Jamil, Deputy Director & Head, Biology Division, Indian Institute of Chemical Technology (IICT), Hyderabad, has been honoured by the Ross Memorial Society during the 'Mosquito Day Observations' and seminar on 'Changing Scenario in Malaria' held in Hyderabad, in the recent past. She also presented a paper entitled '*In vitro* studies on larvicidal endotoxins of *Bacillus thuringensis* in the control of malaria' on this occasion.

Dr N. Krishnamurti

DR N. Krishnamurti, Scientist, Organic Coatings & Polymers Division, IICT, has won 1995 R.B.G.V. Swaika Memorial Award for excellence in development of value-added products from the low- value natural gum olibanum. The byproduct has been utilized as a substitute for wood for making panels, thus providing an eco- friendly technology.

Dr J.P.Misra, Dr V.S. Kishanprasad and Dr P.H. Gedam

DR J.P. Misra and Dr V.S. Kishanprasad, Scientists, Organic Coatings & Polymers Division and Dr P.H. Gedam, ex-Scientist of the same division, IICT, have been selected for the 1996 Dayabhai Vadalia Memorial Award instituted by the Oil Technologists' Association of India (Western Zone). Their paper entitled, 'Pervaporation for dehydration of aqueous glycerol' was adjudged as the best paper published in the *Journal of the Oil Technologists' Association of India* (JOTAI) during 1995.

Also, Dr V.S. Kishnaprasad, has been selected for inclusion in the 14th edition of 'Who's Who in the World' (1997), published by Marquis, USA. The name and biodata of Dr Kishanprasad will appear under the column 'Preeminent Scientists'.

Dr K.V. Raghavan

DR K.V. Raghavan, Director, Indian Institute of Chemical Technology, Hyderabad, has been elected President of the Indian Institute of Chemical Engineers (IIChE), in its Golden Jubilee Year. The IIChE has a membership of over 9000 chemical engineers from all over the country and is served by 37 Regional Centres. Four National and International Conferences are planned during 1997 on chemical engineering topics of current interest. The Golden Jubilee Chemical Engineering Congress will be held at New Delhi in December 1997. It will be attended by eminent chemical engineers from various parts of the world. The Golden Jubilee celebrations will be formally inaugurated at the Headquarters of IIChE in Calcutta on 7 February 1997.

Shri L.R. Meena

SHRI L.R. Meena, Controller of Administration, Regional Research Laboratory, Jammu, has been elected Hon. Vice President (North) of Indian Institute of Materials Management (IIMM), Bombay. Engaged in professional development in the field of Materials Management, IIMM is a charter member of the International Federation of Purchasing and Material Management, The Netherlands. ☐

Announcements

National Conference on Electrochemical Engineering and Technology

A two-day National Conference on Electrochemical Engineering and Technology will be organized by the Society for Advancement of Electrochemical Science and Technology (SAEST) in collaboration with the Central Electrochemical Research Institute (CECRI), Karaikudi, in Chennai on 14-15 March 1997.

The conference will provide a forum to discuss the recent developments in Chlor-alkali industries in India and abroad and identify future directions in this area. It will also provide an opportunity to electrochemical engineers, electrochemists, technologists and industrialists to have an exchange of the latest information and ideas in chlor-alkali, organic and inorganic and similar electrochemical industries. Papers will be presented on: Advances in chlor-alkali and chlorate industries; Electrolytic process development; Electrochemical recycling; Mass transfer in electrochemical systems; Numerical/simulation studies in electrochemical processes, Modelling of electrode reactions/transport phenomena; Modelling and current distribution in electrochemical reactors; Energy optimization in electrochemical process; and Role of electrochemical engineering in pollution control. Plenary lectures related to Chlor-alkali; Electro-inorganic chemicals; Electro-organic chemicals; Pollution control in chemical and electrochemical industries and Electrochemical products will also be presented.

For further details please contact the Secretary, Society for Advancement of Electrochemical Science and Technology (SAEST), Karaikudi-630006 (Tamilnadu). ☐

CBRI Golden Jubilee Conference

Natural Hazards in Urban Habitat

MANY Indian cities and towns are vulnerable to natural hazards such as earthquakes, cyclones, floods and landslides. To avoid large-scale destruction, there is an urgent need to have a well planned mitigation strategy in place. The conference 'Natural Hazards in Urban Habitat' is being organized by the Central Building Research Institute (CBRI), Roorkee. To be held during 10-11 November 1997, the conference will discuss the risks faced by our cities so that governmental preparedness and societal awareness may increase in the years to come.

The conference will provide a forum for R&D workers to exchange ideas with special emphasis on engineering aspects of preventive action and loss minimization.

The following themes will be covered in the conference: Impact of natural hazards on urban environment; Hazard zonation of vulnerable cities; Disaster preparedness; Disaster resistant construction; Disaster management. For further information write to Shri M.P. Jaisingh, Organising Secretary, GJC-NH, Central Building Research Institute, Roorkee - 247 667 ☐

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit

Annual Subscription : Rs. 60
Single Copy : Rs. 3.00

ISSN 0409-7467

CSIR NEWS

VOL 47 NO.2 30 JANUARY 1997

A view of the pilot plant at Regional Research Laboratory, Jammu, for enzymatic resolution of Naproxen — an antiinflammatory drug. The laboratory has signed a contract with Searle (India) Ltd, Mumbai, for the semi-commercial scale trials and transfer of technology for the enzymatic processing of the drug (p 20)

IN THIS ISSUE

CSIR signs MoU with Andhra Pradesh Federation for establishment of Oil Palm Processing Plant 18
[illegible] Nickel [illegible] of Coolant Outer 19
Jacket for Cryogenic Rocket Engine Thrust Chambers
Industrial Electronics at CEERI 21
ITRC celebrates Foundation Day 23
International Conference on Plants and Environmental Pollution 26
Carbohydrate Conference at IICB 28

CSIR signs MoU with Andhra Pradesh Federation for establishment of Oil Palm Processing Plant

A.P. Cooperative Oilseed Growers Federation Ltd, Hyderabad and Council of Scientific & Industrial Research, New Delhi, have entered into a Memorandum of Understanding for establishment of a 10 - tonne fresh fruit bunches per hour capacity oil palm processing plant, on turnkey basis, at Ashwaraopet, District Khamam, Andhra Pradesh. The total contract value of the project is Rs 112.0 million.

It would be the first demonstration plant of this capacity, based on an indigenous technology package. The package has been developed by the Regional Research Laboratory (RRL), Thiruvananthapuram, along with the Mechanical Engineering Research & Development Organisation (MERADO), Madras, a constituent centre of Central Mechanical Engineering Research Institute (CMERI), Durgapur. The Technology Mission on Oilseeds and Pulses, Department of Agriculture & Cooperation, New Delhi, provided the funds for development of the technology package.

A team of scientists from Societal & Technology Missions Division, CSIR, consisting of Shri N.D. Seth, Dr J.S. Khan and Dr (Miss) Chetna Brat, under the dynamic leadership of Shri S.D. Garg, Adviser and Head of the Division, had submitted the offer based upon inputs from RRL-T and negotiated the contract with A.P. Oil Federation, Hyderabad, on behalf of CSIR. Dr R.A.Mashelkar, Director General, CSIR and Secretary to the Government of India, provided guidance and full support to these efforts.

Seen on the dais during the signing of MoU between CSIR and A.P. Cooperative Oilseed Growers Federation Ltd, Hyderabad, (from right): Shri K. Arya, Shri Dinesh Kumar, Dr R.A. Mashelkar, Shri S.D. Garg, Dr A.D. Damodaran, Shri N.K. Sharma and Shri S. B. Krishnan

The MoU was signed on 27 December 1996 at a function held in CSIR Vigyan Kendra, New Delhi, by Shri S.D. Garg, Head, S&T Technology Missions Division, CSIR and Dr A.D. Damodaran, Director, RRL-T, on behalf of CSIR and by Shri Dinesh Kumar, Managing Director and Shri A.V.S. Ramesh Chandran, Manager (P&P), on behalf of A.P. Oil Federation, Hyderabad. Dr R.A. Mashelkar presided over the function.

Special Features of MoU :

- CSIR would implement the project on turnkey basis through licensee project engineering companies including supply, erection and commissioning of plant, equipment, machinery and utilities. A.P. Oil Federation would implement the civil works related to the project.
- CSIR would arrange training of personnel of A.P. Oil Federation and CSIR in management, operation, maintenance and quality control of oil palm processing plants in India and abroad.
- CSIR would adopt consortium approach for implementing the programme by networking the expertise and experience available in A.P. Oil Federation and national laboratories of CSIR synergistically.
- CSIR and NRDC would be paid royalty on technology by the licensee project engineering company implementing the project.
- CSIR would collaborate with A.P. Oil Federation to mobilize partial funding from the Technology Development Board, Department of Science and Technology and the Technology Mission on Oilseeds and Pulses, Department of Agriculture and Cooperation.
- CSIR would guarantee the performance of the oil palm processing plant on following parameters:
  - The process at the rate of 10 tonnes of FFB/h and shell extract

about 93% of the oil present in Fresh Fruit Bunches of Oil Palm.

- The palm oil extracted shall contain less than 4% Free Fatty Acids (FFA) provided the FFB is with optimum maturity, free from damage and processed within 24 hours after harvest.

MoU signing Function

Shri S.D. Garg welcomed the invitees to the MoU signing function held at the CSIR Vigyan Kendra. He highlighted the relevance of undertaking and implementing large-scale projects based upon technologies developed in CSIR, for high impact and visibility. He said that the CSIR Director General had enunciated future directions for R&D in *CSIR 2001 : Vision & Strategy*, which laid stress on development of internationally competitive technologies. The present technology can be taken as a step towards realizing this vision. Shri Garg appreciated the cooperation received from RRL-T, TMO&P, NRDC, NCDC, TDB in success of the programme.

Dr A.D. Damodaran, in his opening remarks, emphasized that technology development undertaken by RRL-T was tailored to suit the domestic requirements of plantation programme. He stressed that Red Palm Oil (RPO) has great potential to overcome vitamin A deficiency among children, especially those from low income groups, causes various diseases and it would be appropriate to set up plants to produce RPO in the country. He lauded the contributions made by Dr C. Arumughan and Shri A. Sunderasan, Scientists of RRL-T, in development of the technology.

Shri N.K. Sharma, MD, NRDC, appreciated the initiatives of CSIR in establishing oil palm processing technology in the country. He remarked that there is a great scope for export of this technology and NRDC would exploit this potential.

Shri Dinesh Kumar recalled the association of A.P. Oil Federation with CSIR in establishing first prototype palm oil mill at Pedavegi, Andhra Pradesh. He stated that with further improvization, the plant has extracted more than 20% oil from oil palm during the year 1996. The performance of this plant based on indigenous technology was as good as that offered by other countries. A decision to establish a new palm oil mill of higher capacity based on indigenous technology in collaboration with CSIR has been taken with this perspective, and it is expected to be one of the best plants. He hoped that all the concerned organizations would work together to establish a modern palm oil mill at Ashwaraopet, Andhra Pradesh.

In his address, Shri K. Arya, Joint Secretary, Technology Mission on Oilseeds and Pulses, opined that oil palm is plant of the future for bridging the gap between demand and supply of edible oils in the country, as it produces maximum oil per hectare in comparison to all other oil seeds. He lauded the role of CSIR scientists in developing oil palm processing technology which has provided great boost to oil palm plantation programme. Congratulating the CSIR scientists for the success achieved he stated that all scientists should feel proud on this occasion.

Expressing his happiness, Dr R.A. Mashelkar remarked that this project heralds a new era in CSIR, where all stake holders, namely R&D scientists, user industry, project engineering companies and technology development funding agencies would work together to establish a state-of-the-art oil palm processing plant based on indigenous technology developed in a CSIR laboratory. He cautioned against complacency and emphasized that all efforts must be made to maintain international competitiveness in the technology while establishing the plant on turnkey basis through the licensee project engineering companies.

Shri N.D. Seth, Joint Adviser, CSIR, thanked the distinguished invitees who had extended cooperation at different stages and participated in the programme to make it successful. ❑

CECRI Expertise on Nickel Electroforming of Coolant Outer Jacket for Cryogenic Rocket Engine Thrust Chambers

THE Central Electrochemical Research Institute (CECRI), Karaikudi, has been engaged in R&D programmes relating to electroforming of complicated structures required for various critical applications, for the past two decades. One such programme is the nickel electroforming of the outer jacket of the 1-tonne cryogenic rocket engine for the ISRO's Space Programme.

Recently, the Liquid Propulsion Systems Centre (LPSC) of ISRO supplied an oxygen-free high conductivity copper inner shell having 45 coolant channels cut in longitudinal direction by the CNC machining technique. The length of this chamber was about half a metre and di-

1 - Tonne cryogenic rocket engine assembly

ameter of around 125 mm. The channels were filled with wax and conductivized. Thereafter nickel was electroformed to a uniform thickness of 8 mm, employing sulphamate electrolyte under optimised conditions to achieve the specified mechanical properties of ultimate tensile strength 55 kg/mm^2, yield strength 38 kg/mm^2 and elongation 20%. Both ends of the chamber were provided with extra thickness of 20 mm of nickel employing specialized techniques for joining the inlet and outlet manifolds for the flow of liquid hydrogen.

After nickel electroforming and wax removal, precision machining

RRL Jammu — Searle (India) tie-up for the semi-commercial scale trials and transfer of technology package for the enzymatic resolution of Naproxen

SEARLE (India) Ltd, Mumbai, a bulk agrochemical/drug producing organ of RPG group of companies, has signed a contract with the Regional Research Laboratory (RRL), Jammu, for pilot demonstration, larger-scale trials and transfer of the technology of a biotechnological process for the enzymatic processing of anti-inflammatory drug — Naproxen. The company, after obtaining demonstration of the process at the laboratory's pilot plant has offered to closely cooperate and join hands with the laboratory for conducting semi-commercial scale trials at RRL-Jammu. The trials are expected to be over before the end of this year. The laboratory has in return offered to the company the transfer of property rights of the process and the specially developed yeast strain for its utilization in India; for which a suitable down payment and handsome royalty shall be paid by the company to the laboratory. While the efforts of RRL-Jammu in pursuance of the latest CSIR policy are to give best advantage to the Indian company so as to make it globally competitive with regard to the product, the transfer of process know-how at the international level is also being considered by the laboratory.

RRL-Jammu had earlier announced and filed the process patent for the development of a strain of yeast having an excellent selectivity (99:1) for recognizing one of the two enantiomers of Naproxen. Taking advantage of such a unique selectivity the organism was ingeniously exploited for the resolution of S(+) Naproxen from its R(-) enantiomer. The S(+) Naproxen is the potent and relatively safer anti-inflammatory drug widely sold as OTC (over the counter) drug in USA. The global demand of the drug is of the order of $ 200 million. The drug produced by RRL-Jammu bioprocess complies with the stringent United States and British Pharmacopoeia standards and can therefore be produced in large quantities for its export to the United States and Europe. The process of the mass scale propagation of highly active yeast culture and enzymatic resolution of the drug (Naproxen) was studied and scaled-up in a record time of two years under the background of excellent expertise of the team of scientists engaged in the endeavour. The biotechnological process was developed with overall coordination of Prof. S.S. Handa (Director of the Institute) by a team of Scientists under the project leadership of Dr G N Qazi, Scientist 'F' and Head of Biotechnology Division at RRL-Jammu. Besides a host of scientific & technical participants in the project, the major contributors for the success of the development of the enzymatic resolution process are: Dr S.C. Taneja, Dr Rajender Parshad, Dr S. Koul and Shri C.N. Gaind. The development of the biotechnological process of the resolution of Naproxen is a major breakthrough of this laboratory, obtained through close multi-disciplinary approach for the implementation of research projects. □

processes were carried out. This engine underwent various pre-qualification tests like leak and pressure calibration tests, and subsequently 'hot tests' successfully many times for short and long durations at Mahendragiri, LPSC/ISRO. LPSC has successfully conducted a hot test on this engine for a duration of 200 seconds with liquid hydrogen and liquid oxygen.

CECRI has also undertaken R&D on nickel electroforming of a higher thrust engine, developing 12 tonnes of thrust and the chamber has been successfully electroformed. The institute has also completed a project for the development of copper electroforming process for the fabrication trials of Cryogenic Upper Stage (CUS) main engine and steering engine thrust chambers. □

Industrial Electronics at CEERI

THE recent awareness about rapid exhaustion of fossil fuels on one hand and the excessive consumption of energy on the other, has led to the present energy crisis. In this context, it is essential to go for modernization of core sector industries such as power and transportation, by employing latest energy- saving, eco-friendly, quality and cost-effective electronics systems.

It is estimated that more than one-third of the total energy consumption in India is wasted owing to its inefficient use. The efficiency of electric motors, the work-horses of industry, plays a very significant role in overall energy consumption. Therefore, converters, inverters and drives have become backbones of modern industries. Advances in this field are primarily linked with innovation in power semiconductor devices, power electronics techniques and microelectronics. It is predicted that by the year 2005, the new generation of highly efficient technologies would change the fabric of industrialization, and wide-spread use of power electronic controls is expected to transform energy management scenario of the world.

Excitation control system for diesel electric locomotive.

Great amount of awareness has been created and different sectors like Steel, Coal, Power, Transportation, Fertilizers, Chemical and other process industries have already witnessed the introduction of latest power electronics equipment. There has been a rapid increase in the use of power electronics, and more and more products based on newer technologies are entering the consumer market. Absorption of these technologies for self- reliance is a must to meet the challenges of the 21st century.

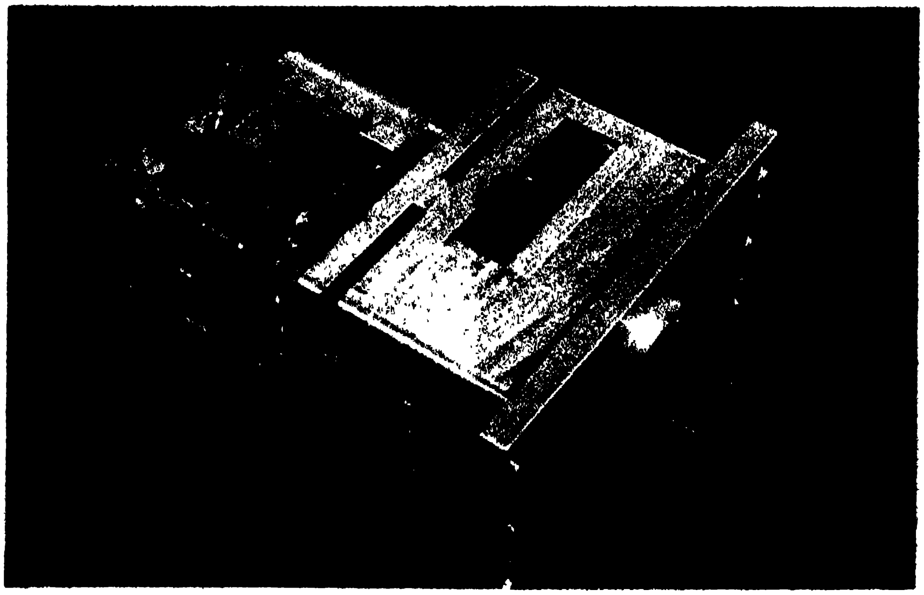
Significant Achievements of CEERI

Recognizing the importance of the solid-state AC drive for energy saving, the Central Electronics Engineering Research Institute (CEERI), Pilani, initiated R&D work on this technology in the late seventies. The earlier success came in the form of import substitution of transistorized excitation control system for diesel-electric locomotives, which has been used in more than 2000 diesel locomotives. Subsequently, CEERI gained the expertise in medium power technology by developing 150 kVA single-phase to three-phase static converter for WAM4 electric locomotives, under the sponsorship of RDSO, Lucknow. With the initiation of R&D work on 40 kVA PWM three-phase thyristor inverter for eight- tonne mining locomotive for BHEL, Bhopal, CEERI entered into the transportation sector. In early eighties, international scientific collaborations with the University of Bradford, UK (1982) and University of Wisconsin, USA (1984) were signed and successfully completed. In late eighties, CEERI developed 50 kVA variable frequency, variable-voltage AC motor drives and 50 HP soft starter, to demonstrate the scope of energy saving utilizing these techniques.

In line with the CSIR policy of promoting industrial research and with due consideration for the small-scale industries sector (SSIs), CEERI, in early nineties, developed a range of low- power UPS (100VA, 150VA and 500VA), particularly suitable for rural applications. The technology was transferred to SSIs for commercial exploitation, and was also utilized for the batch production of UPS to meet the requirements of the Literacy Mission. A high power density (1.5 watt per cubic inch) DC to DC converter was developed for M/s MECON India Ltd, Ranchi. In the early nineties, the Department of Electronics, New Delhi, sponsored to CEERI, the development of a 50 kVA unity power factor converter to reduce the heavy line-loss owing to reactive power generation by frontend converter of solid-state equipment. CEERI also contributed to meet the strategic requirement of the nation by undertaking and completing the development of PWM amplifier for electromechanical actuator for ADE, Bangalore.

In recognition of its pioneering role in development and promotion of electronics technology (control system for diesel locomotive), the institute received the FICCI award in the year 1979.

Chopper control for mining loco



PWM Amplifier for electromechanical actuator

On-going Projects

Anticipating the relevance of Electric Vehicles in Indian context, national planners and the Government of India identified it as one of the major thrust areas. CEERI took up R&D work on AC (induction) motor drive as a part of the multidisciplinary electrical vehicle development programme, and demonstrated the country's first AC (induction) motor-driven electric vehicle in 1994. The performance of AC motor drive is currently being evaluated for a two-seater car. The institute has undertaken the responsibility of supplying three units of 70 kVA transistor chopper controller for mining loco. The prototype has already been field tested at Hindustan Zinc Limited, Zawar Mines, Udaipur.

Though a variety of UPSs are available in the Indian market, high-performance, low-cost, reliable and quality 10 kVA UPS still has a good market; CEERI has taken up its development recently. The other products under development are multifunction meter for M/s Contimeter Pvt. Ltd, New Delhi, and speed indication and recording system for use in Indian Railways, under the sponsorship of M/s Stesalit Ltd, Calcutta.

Over the years, CEERI has developed a well-equipped power electronics laboratory and is continuously updating the knowledgebase in the frontier technologies with latest innovations to meet the technological revolution in the field of power electronics.

Future Plans

The institute has planned its future activities to meet the national objectives with due consideration to industrial needs. The user sectors indentified by CEERI for its future activities are power, transportation and other core industries. The areas proposed for future development activities are: user specific converters and inverters for industrial and strategic applications, motion and position control systems using various drives, intelligent diagnostic and control systems for electric and diesel locomotives. ❑

ITRC celebrates Foundation Day

THE Industrial Toxicology Research Centre (ITRC), Lucknow, celebrated its thrity-first Foundation Day on 4 November 1996. Dr Chandan Prasad, Professor and Vice Chairman (Research), Department of Medicine, Section of Endocrinology and Metabolism, Lousiana State University Medical Centre, New Orleans, was the Chief Guest and delivered the Foundation Day address. Dr (Smt) G.V. Satyavati, Director General, Indian Council of Medical Research (ICMR), New Delhi, presided over the function.

ITRC Foundation Day function. Seen on the dais (from left): Dr N.K. Mehrotra, Dr Chandan Prasad, Dr (Smt) G.V. Satyavati and Dr R.C. Srimal

Dr Chandan Prasad while delivering the Foundation Day address, observed that for over three decades after the World War II, biomedical research received total support without serious accountability, but the support for the basic research started declining in early seventies. The reasons for this decline, he said, are largely due to the fact that scientists have not been able to convince the public, the tax payer, the need for basic research and that, scientists have lived in ivory towers for so long that they never thought of accountability. He suggested some basic parameters to fund and foster research, which had proved to be quite successful in his own institution. Some of these are : Treat research like a business, Initiate collaborative research to save resources and avoid duplication, and Treat research to save resources and avoid duplication, and Treat research outcome as a product and invest heavily in personnel training.

Dr (Smt.) Satyavati in her presidential address said that mankind in its eternal quest for better life has made tremendous advances in science and technology, but these very advances have resulted in many health hazards and even threat to human life. She stressed the importance of undertaking research on the adverse environmental impact of growing industries of all varieties and magnitude, where research institutes like ITRC have to play a significant role. She lauded the contributions of ITRC in chemical safety as related to industry and environment and in frontier areas of research like cellular and molecular biology and other areas involving biotechnology.

Referring to the collaborative work between ITRC and ICMR, she said that the two institutes have jointly developed safety standards and guidelines for toxicity testing of various chemicals. The results of studies on safety assessment of commonly used materials such as cosmetics, detergents, plastics, polymers, food additives, dyes, pesticides, etc. can be taken up as they have been of great importance to the regulatory agencies of the country. She stressed that research today has to be multidisciplinary and multidimensional and therefore demands team work. Only this team work alongwith commitment and dedication to reach the set targets (along carefully planned and designed research protocols and according to set time schedule and in a goal-oriented manner) would produce best results. She said that ITRC has the potential to reach much greater heights of scientific excellence and achievements, and wished ITRC scientists and the supporting staff great success in the years to come.

Earlier, presenting the annual report of his institute, Dr R.C. Srimal, Director, ITRC, said that ITRC continued to participate in National Mission Programmes, National Coordinated Programmes, CSIR Global Climate Change and Antaractica Programmes. The R&D programmes of the institute are being carried out keeping in view *CSIR Vision 2001* and requirements of the country. The major activities of the part year were:

Under the Drinking Water Mission, ITRC continued to provide technologies for water quality analysis and disinfection of drinking water in the problem districts. To assess the improvement, re-evaluation studies undertaken at Kangra district showed a significant reduction of faecal contamination of drinking water. A potential defluoridating material has been prepared to remove flouride from water. One kilogram of this material will suffice to defluoridate water containing up to 10 ppm fluoride for about 300 days with daily output of 20 liters fluoride-free water.

Under the Technology Mission on Edible Oil and Pulses, ITRC has developed a fluoresence detection device, through which the common toxic adulterant, i.e. admixture of *Argemone mexicana* oil in edible oil can be detected.

Monitoring and assessment of *Gomti* river water is being continued at 8 locations between Nimsar and Jaunpur, spread over a stretch of about 400 km, under the sponsorship of National River Water Conservation Directorate, Ministry of Environment & Forests, Government of India. Under the project, ITRC data on the river water and sediment quality parameters have been found as the best amongst the data obtained by all the participating laboratories.

To strengthen interaction with industries, a Business Development and Intellectual Property Management Group has been constituted. The institute continued to undertake environmental impact assessment studies, environmental audit studies, ecofriendlyness, and safety assurance of the chemicals and products. R&D services to several major industries were provided for the safety evaluation of their chemicals and finished products. Residue analysis of pesticides, metals and other contaminants were also continued. Such studies help industries in obtaining registration, affiliation and certification for produce use and exporting their products. To meet the specific requirements of the industry. ITRC develops, from time to time, new test protocols and methods. The institute has taken several steps to implement good laboratory practices.

Studies on the toxicity of asbestos showed that chrysotile is injurious to human bronchial epithelial cells. Glycolic acid (an antioxidant present in sugarcane) was found to effectively scavenge superoxide radicals responsible for oxidative stress leading to degenerative disorders. Studies on oxidative stress mediated calcium deregulation showed that diazepam produces region specific changes in certain brain enzymes.

Certain phytoplankton and zooplankton have been found to be vulnerable to small increment in UVB (which is likely to increase because of stratospheric ozone depletion). This indicates that even a small increase in UVB has impact on biomass production in marine food web.

Studies were continued on potential of stress genes for an early detection of cytotoxic response of a cell against environmental pollutant in transgenic drosophilia with stress on gene promoters fused with receptor gene beta-galacotosidase.

Studies on microbial degradation of pesticides and other chemicals and bioremediation through biological approaches showed that *Pseudomonas sp.* (Strain EL-1), capable of biodegrading all four isomers of lindane can also degrade 80% of the pesticides from a contaminated soil, during a period of five weeks. A bacterial strain, PCP-

5, was found to degrade DDT and DDE also. A microbial consortium capable of sulphur removal and methanogenesis from distillery waste water has been developed. Also, optimal conditions for nickel removal from solutions by isolated strain of *Klebsiella* have been established.

The role of sediment bound humic acid in detoxification of pollutants using simulated model system and the kinetics of Cd, Pb, Cu, Cr, Fe, Ni, Hg and Mn was found to be *p*H dependent.

The studies on pesticides showed that workers engaged in manufacturing quinalphos suffer from symptoms related to central nervous system and that activity of serum cholinesterase is not only decreased in such workers but also in those who work in vicinity of the manufacturing units, indicating the spread of the pesticide to surrounding areas. Neurotoxicity studies of quinalphos on non-target species indicated that long-term exposure decreases all aspects of spontaneous locomotor activity and also leads to development of tolerance/tachyphylaxis with possible adaptive changes in the DA receptor. Quinalphos was also found to affect the cardiovascular system, as rabbits exposed to this pesticide for 3 months exhibited a fall in blood pressure and decrease in heart and respiratory rates. Developmental neurotoxicity studies with cypermethrin showed that low-level exposure can effect the acetylcholinesterase activity and disturb the motor function.

The studies on blood brain barrier indicated that it plays an important role in protecting the brain from the toxic effects of the chemicals and endogenous products. Exposure to quinalphos and cypermethrin in low doses was found to increase the permeability of this barrier. Studies on the mechanism of the neurotoxicity of quinalphos showed that it alters the brain free-radical generation and the enzymes involved in their scavenging. In rats, quinalphos-induced toxicity was found to be due to the parent compound and not to its cytochrome-P-450 mediated metabolites. Experimental studies on the toxicogenic potential of cypermethrin and deltamethrin showed that these pesticides increase the frequency of sister chromatid exchange in the bone marrow, indicating their genotoxicity. Studies on the No-Observed-Adverse Effect Level (NOAEL) of quinalphos have established 2 mg/kg for this pesticide. It was fouund to possess dermal toxicity potential in guinea pigs.

Studies on the capability of brain to handle drugs and chemicals have shown existence of regional specificity in the expression of cytochrome P-450 2B1/B2 isoenzymes, as judged with specific antibiodies.

Studies on peripheral markers had earlier shown that blood platelet and serotonim receptors could serve as peripheral markers for some neurological disorders. Studies carried out now on the mechanisms by which the platelet receptors get modulated show that circulating levels of the neurotransmitters, like in brain, can modulate the respective receptors.

Detailed biochemical, immunotoxicological and histopathological studies on the toxicogenic potential of gasoline-methanol mixture through dermal exposure established that likely toxic potential of the blend is of significant importance. Exposure to gasoline was found to affect the lymphoid organs and suppress the humoral immunse response. Mechanistic studies with benzene, an important constituent of gasoline, showed that glutathionyl hydroquinone (GHQ), one of the toxic metabolite of benzene, to be a potent pro-oxidant.

Using the newly acquired inhalation chamber, studies were made on the toxicity of a commonly used solvent — trichloroethylene (TCE). TCE was found to suppress the local immune response in lungs without any significant alteration in general immunity.

Methods to monitor toxic metals and various metal species in the environment were updated and validated. A document on the permissible limits of arsenic in drinking water was prepared in view of the wide-spread incidence of arsenic poisoning in West Bengal. Reference materials for nitrate and multielement (Zn,Cu,Fe) were developed and submitted to National Physical Laboratory, New Delhi, under the collaborative programme on Indian Reference Materials.

The information retrieval and dissemination have been further strengthened with the acquisition of two more databases: Asian Health, Environment and Allied Database (AHEAD) Series and BYERS Guide. These will help in providing immediate answers to problems related to identification of chemical risks in occupational and industrial environment, development of capabilities in avoiding chemical accidents and in formulation of regulatory guidelines.

A number of public awareness programmes were undertaken. In an All India ICMR-sponsored multicentric study for evaluation of the magnitude and usage pattern of artificial synthetic colours in ice-candy and crushed sweetened ice samples, in four city markets in Gwalior, Indore and Bhopal and ten neighbouring villages, it was observed that ice candy contained only permitted colours, although the quantity of permitted colours added exceeded the prescribed concentration by several folds in many samples. On the contrary, in crushed and sweetend ice, not even a single sample contained permitted colours; all the samples had non-prescribed colours. Another survey showed that around 85% of sweetened crushed ice samples contained saccharin. In ice candy samples, especially orange bars, 63% of the local brands employed saccharin as sweetening agent.

ITRC organized public awareness camps at Shirdaspura (Jaipur), Singhman (Lucknow) and Gorakhpur. The scientists examined children and local inhabitants at Shirdaspúra and Jaipur and found that more than 60% children have symptoms of dental fluorosis.

As part of the Human Resource Development programme, ITRC organized two training programmes on 'Water Quality Analysis' and 'Safety Evaluation of Chemicals'. Another training course on 'Standard Methods Employed in Pollution Control Laboratory', sponsored by Uttar Pradesh Pollution Control Board, was also organized. A workshop on 'Impact of Pesticides on Environment and Human Health' was also organized.

Dr N.K. Mehrotra, Deputy Director and Head, Environmental Carcinogenesis Section, proposed a vote of thanks. ❑

International Conference on Plants and Environmental Pollution

THE first International Conference on Plants and Environmental Pollution was organized by International Society of Environmental Botanists (ISEB) in collaboration with the National Botanical Research Institute (NBRI), Lucknow. The conference was co-sponsored by UNESCO, IUBS, Commonwealth Science Council, Indian National Science Academy, Council of Science & Technology (U.P.) and Lucknow University. Ministry of Environment & Forests, Department of Science and Technology and Department of Biotechnology, Government of India, also supported the conference. It was attended by over 200 delegates from India, UK, USA, Sweden, Germany, Greece, Japan, France, Canada, Philippines, Sri Lanka, Malaysia, Nepal, The Netherlands, Slovakia and Russia.

The main aim of the conference was to focus on the role of plants in indication and abatement of environmental pollution and in providing bioaesthetically sound and sustainable environment on earth. It provided an international forum for wide ranging discussions on environmental problems and issues of global concern, such as climate change, environmental impact and risk assessment, urban pollution, heavy metal pollution, wetland pollution, environmental biotechnology and biodiversity, education and mass awareness, bioaesthetics, bioremediation and bioactivity and residue management. A special session on '*Neem* - The Tree of the Future' was also organized.

In his welcome address, Dr P.V. Sane, President of the ISEB and Director, NBRI, elaborated the genesis of this conference. He drew the attention of the participants towards imminent disaster facing the earth owing to the injudicious use and over exploitation of natural resources. Dr K.J. Ahmad, Organizing Secretary of the conference, briefly outlined the histroy of ISEB and explained the aims and objectives of the conference.

The conference was inaugurated by Prof. Richard F.E. Crang, Professor of Plant Biology, University of Illinois, USA. Prof. J.N.B. Bell of Imperial College of Science, Technology & Medicine, London, UK, was the Chief Guest at the function.

In his address, Prof. Crang lamented that owing to degradation of the ecosystem, the world is losing about 25,000 species each year. Discussing the direct and indirect effect of pollution, he observed that the impact of pollutants on reproductive processes, hormonal activity and secondary compounds was yet to be understood fully. Expressing his deep concern about India, he said that despite its ecosystem and rich biodiversity, the country, because of various environmental problems, which are largely global, is finding itself in a most precarious situation. He advised that we need to use our scientific knowledge to instil wisdom in the abatement of pollution, the control of human population, the development of sen-

Prof. Richard F.E. Crang delivering the inaugural address. Sitting on the dais from left are: Dr P.V. Sane, Prof. J.N.B. Bell, Dr B.P. Singh and Dr Prakash Chandra

sible and sustainable agriculture and the retention of biodiversity.

Prof. Bell, in his thought provoking address, expressed his deep appreciation on organizing this unique conference in a leading developing country like India, where the problems of environmental pollution are more acute than the developed countries *vis-a-vis* rapid industrialization, urbanization and increasing traffic congestion.

A total of 61 oral and 49 poster presentations were made in 19 sessions during the five-day meet. Four special lectures were also organized in the conference. These were : Climate change convention : issues for the developing countries (Prof. S.K. Sinha, India); Seabuckthorn : a multipurpose plant for economic, medicinal and eco-development of cold desert Ladakh (Dr Shahsi Kant, India); Floristic summary of North American plant species in the air pollution literature. (Prof. J.P. Bennett, USA); and Effect of air pollution on insects (Prof. J.N.B. Bell, UK).

Two awards each for best poster presentation in the two poster sessions were given on the basis of the recommendations of an International Selection Committee:

Session 1— *First Prize*: Evalution of plants growing around a cement factory (J. Misra, N. Singh and M. Yunus); and *Second Prize*: D1 and D2 proteins degradation and psbA and psbD/C transcript levels during UV-B inactivation of photosynthesis in *Chlamydomonas reinhardtii* (R. Chaturvedi and R. Shyam).

Session 2 — *First Prize*: Micro nucleus test as indicator of clastogenic effects of arsenicals on plants *in vivo* (B. Bandyopadhyay); and *Second Prize*: Lead-mediated synthesis of metal-binding peptides (phytochelatins) in the submerged plant *Vallisneria spiralis* L. (M. Gupta, R.D. Tripathi, U.N. Rai and P. Chandra).

The valedictory function was presided over by Dr Sane. Following recommendations were made by a committee comprising Dr Sane, Prof. Crang, Prof. Bell, Prof. C.K. Varshney, Dr B.P. Singh and Dr K.J. Ahmad:

1. While the widespread and insidious nature of atmospheric pollution and its hazards to human health are known since as early as industrial revolution, there is now a growing evidence that crop fields are also adversely affected causing a serious decline in food production and consequent economic losses. This threat has hitherto remained largely overlooked. Also, the threat posed by increasing level of tropospheric ozone. due to its rural bias, is indeed quite alarming. In view of this, a national and global monitoring network should be established and long-term research programmes be initiated.

2. While pollution control at source and the use of clean technology should continue to be accorded highest priority for reducing environmental pollution, the role of plants in the abatement of pollution and in aesthetic improvement of the environment should also receive adequate attention. Efforts should continue to create green belts on sound scientific principles as a complementary measure for pollution abatement.

3. Heavy metal pollution of soil is a relatively undefined phenomenon, leading to irreversible deterioration of ecosystem. It may also result in the building up of metal toxins in plants that will have impact on food webs, endangering animal and human health. The soil quality should therefore be given the same level of environmental recognition as accorded to water and air quality.

4. Many modern agricultural activities are posing adverse impact on the environment, particularly through the use of excessive agricultural chemicals. It is therefore necessary to accord high priority to environmental research and education in all education programmes for promoting sustainable agriculture.

5. While there is now a strong evidence of global climate change, there is a poor understanding of its implications at regional and local levels. Systematic scientific efforts are needed to ascertain the impact of impending climate change on biodiversity and on socio-economic aspects across the wide range of Indian climatic zones.

6. Increasing emphasis on environmental education is necessary to promote greater environmental awareness among politicians, administrators, decision-makers and, to transfer the fruits of research to grassroot level, through public participation. □

Carbohydrate Conference at IICB

THE eleventh Carbohydrate Conference, organized jointly by Indian Association for the Cultivation of Science (IACS), Calcutta, Association of Carbohydrate Chemists & Technologists (India) and the Indian Institute of Chemical Biology (IICB), was held on 21- 22 November 1996 at IICB, Calcutta.

The theme of the conference was 'Recent trends in glycoscience'. It discussed new developments in carbohydrate research.

In his welcome address, Dr J. Das, Director, IICB, regretted that carbohydrate research has not been highlighted in the past. Only recently the importance of research in this area has been realized. He pointed out that sugar molecules play a vital role not only in various recognition processes and in the manifestation of pathogenesis, but can also be a potential candidate for treatment and cure of a number of diseases including AIDS and cancer. He made a fervent appeal for higher allocation of funds in this area.

Dr D. Chakraborty, Director, IACS, stressed the role of carbohydrate research in solving problems of food, cloth and shelter for the common masses. Presiding over the function Prof. N.K. Mathur, President of the Association of Carbohydrate Chemists and Technologists (India), elaborated on the glorious past of the Association in encouraging carbohydrate research. He also spoke in details about the past research in this area and the new directions for the future. Dr A.K. Mukherjee in his keynote address, pointed to the various crucial areas and topics to be covered by the conference. Dr A.K. Sen (Jr.) offered a vote of thanks.

The conference received overwhelming response from the carbohydrate chemists and technologists engaged in research in different branches of this subject from all over India. A good number of papers were presented and discussed. A booklet containing the abstracts of the papers presented at the conference was also released. □

Dr B. Mukerji Memorial Lecture

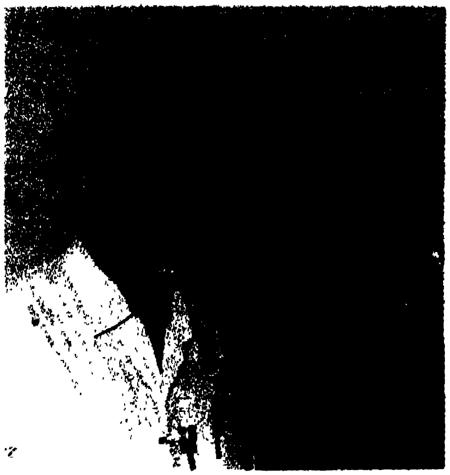
Vanishing and Vanquishable Diseases

THE second Dr B. Mukerji Memorial Lecture on 'Vanishing and Vanquishable Diseases' was delivered by Prof. T. Jacob John, Emeritus Scientist, Christian Medical College, Vellore, at the Central Drug Research Institute (CDRI), Lucknow. This lecture series has been sponsored by the Sachin & Sikta Pradhan Foundation, Bethesda, USA. Pradhan was a student of Dr B. Mukerji.

At the outset, Dr V.P. Kamboj, Director, CDRI, briefed about the contributions of Dr B. Mukerji, the first Indian to take over the Directorship of this institute, about nine months after its dedication to the nation, and who was instrumental in building it into a premier laboratory during his 10 years' leadership.

Prof. B.N. Dhawan, former Director, CDRI, presided over the function. He introduced Prof. Jacob John and highlighted his contributions towards giving pulse vaccination approach for the elimination of polio.

Prof. John in his lecture emphasized that several major problems have been solved in the past with minimum facilities. One should take a lesson from the past and should move with great will and courage to solve the current health problems. He told that with clean food, water and environment, the



Prof. T. Jacob John, Emeritus Scientist, Christian Medical College, Vellore, delivering Dr B. Mukerji Memorial Lecture at CDRI

western countries have eliminated the tropical diseases, such as cholera, typhoid and malaria. The development of antimicrobials, pesticides and vaccines towards the second half of this century, has contributed largely in controlling/containing the diseases. Some of the diseases got eliminated of their own, for example encephalitis lethargica, plague, etc. Some others like Ebola virus appeared in Brazil in 1993, *V. cholerae* 0139 in Bangladesh in 1994, plague in India in 1995 and got contained. Smallpox was eliminated in USA by 1960 by using 3 doses rhythmic oral polio vaccine approach. However, the same approach was not successful in India. With the use of 5 doses pulse oral polio vaccine approach, we had reduced the incidence of polio consideraly by 1994 and if God willing we should be able to eliminate this disease by the year 2000. Thus, each country may need a separate strategy and approach to contain and control a particular disease. Intervention strategy may further improve performance. However, adequate surveillance and mass immunization can always help eliminate many viral diseases. Smallpox has been eliminated using this approach. India at that time had developed a weekly reporting system from village to district to state headquarters to Delhi. Unfortunately, this effective system got dismantled alongwith smallpox eradication.

Prof. John stressed that public health building system like the one mentioned above is essential to contain and control diseases. Another success story he highlighted is of guinea worm disease. The incidence of 3.5 million cases in 1986 all over the world has been reduced to 13,000. In India, the incidence of this disease in 1995 is only 60 cases and we may be able to eliminate it by 1997.

The pulse vaccine approach which was used to eliminate smallpox should be used for the elimination of other viral diseases like measles, mumps, etc. and we can successfully eliminate these diseases within 4 to 5 years. With proper drug therapy, even a disease like filariasis has been projected to be controlled by the year 2000. Here the strategy is to provide pulse drug therapy once or twice a year. With multiple drug therapy. India is also hopeful of controlling leprosy by the year 2000.

He emphasized that the surveillance and diagnostics facilities are the backbone of a successful health care programme. The four pillars of primary health care are: immunization, environment, nutrition and medical care. Thus by coupling strategies of immunization with clean environment, food and water supplemented with proper medical care, most of the viral, protozoal, helminthic, and may be even bacterial diseases, can be controlled and eradicated, he concluded.

Dr O.P. Asthana, Convener of the CSIR Science Foundation Day Programme, proposed a vote of thanks. ❑

Vanadium Phosphorous Oxide Catalysts for Ammoxidation of 3- Picoline to 3-Cyanopyridine

NIACIN (nicotinic acid) and niacinamide (nicotinamide), the constituent members of vitamin B complex group, play an important role in the metabolism of mammals. The ammoxidation of 3-picoline to 3-cyanopyridine is the essential step in the production of niacin and niacinamide, and hence, has gained tremendous industrial importance. 3-Cyanopyridine (or nicotinonitrile) can be transformed easily by catalytic hydration to niacinamide and niacin. For catalyzing ammoxidation of alkyl substituted N-heteroaromatic compounds in general and 3-picoline in particular, a number of catalysts comprising vanadium oxides have been proposed. However, the conventional catalysts have too strong or too weak catalytic properties for the ammoxidation of alkyl substituted heteroaromatic compounds. As a result, abnormal reactions such as dealkylation or cleavage of the heteroaromatic ring take place with these catalysts.

The heteroaromatic nitriles can be prepared with high selectivity and yield using vanadium phosphorous oxide (VPO)-based catalysts since the VPO catalysts possess good resistance against heat, reduction and are also safe in operation.

Shri B. Manohar of the Indian Institute of Chemical Technology (IICT), Hyderabad, has carried out a systematic study to develop an efficient VPO-based catalyst for the ammoxidation of 3-picoline to nicotinonitrile. An additional objective of this study was to obtain an insight into the structure of the catalyst and the relation between the structure and catalytic activity for ammoxidation of N-heteroaromatic compounds. A number of VPO, supported VPO, promoted VPO, and supported and promoted VPO catalysts were prepared by using aqueous and non-aqueous solvents as reducing agents, and characterized by means of several physico-chemical methods like, XRD, ESR, FTIR, DTA, SEM, ammonia chemisorption and BET surface area measurements. These catalysts were also evaluated for the ammoxidation of 3-picoline to 3-cyanopyridine at normal atmospheric pressure.

The comparative study on VPO and VPO/SiO_2 catalysts revealed that the catalysts obtained via the organic method give a better performance than their equivalent aqueous samples. Further, the VPO/SiO_2 catalyst gave better performance than the unsupported VPO. The enhanced activity of VPO/ SiO_2 was found to be related to increase in the exposed area of the active VPO phase on the support surface. In the case of vanadium antimonate-based catalysts, the Sb-VPO/Al_2O_3 catalyst exhibited better performance than the equivalent Sb-VPO catalyst. Antimony was selected as a promoter in view of its better catalytic behaviour in propane ammoxidation. In Sb-VPO mixed oxide, the antimony exerts the reducing effect like solvent and an increase in Sb-content increases the reduction of vanadium (V) to vanadium (IV). A redox cycle between V^{+4} and V^{+5} species is known to be responsible for the steady state activity of catalysts. Addition of antimony also weakens V=O bond strength allowing rapid exchange of oxygen. Here too the enhanced activity of Sb-VPO/Al_2O_3 catalyst was found to be related to the presence of highly dispersed, more active VPO phase and the formation of active $AlSbO_4$ phase. Other additive atoms such as Cu, Zr, Co and Mn in micro quantities were incorporated into the VPOs to enhance their activity. However, the unpromoted system exhibited greater activity over promoted systems. The detailed characterization studies revealed that the promoter atoms do not enter into the phosphate layers to form intercalated compounds as expected. These additive atoms are simply present on the surface as micro crystalline solid solutions. Therefore, the activity of the unpromoted VPO is more than that of the Cu, Zr, Co or Mn-incorporated samples.

Shri B. Manohar carried out these studies under the supervision of Dr B.M. Reddy, Scientist, Inorganic & Physical Chemistry Division, IICT, and was awarded Ph.D. degree in Chemistry by the Osmania University. ❑

Shaping the Future: Management's Agenda and Dynamics of Public Relations

SHRI S. Azeez Ahmad, Head, Publications & Public Relations, Centre for Cellular & Molecular Biology (CCMB), Hyderabad, attended the Global Symposium on the title theme. Held in Mumbai, during 7-9 November 1996, this mega event was organized by the International Public Relations Association, under the sponsorship of Tatas. This was one of the biggest symposium in the area of Public Relations, where more than 300 delegates from India and abroad (23 countries) participated. Spread over 11 sessions, 44 speakers presented papers on a wide range of topics ranging from Technology Exploration to Networking with Global Media and Free Markets to Environment & Economic Development. The keynote addresses were delivered among others by such eminent personalities as Ms Rebecca Mark, Chariman & CEO, Enron Development Corporation, USA; Shri Narendhra Morar, BBC Worldwide Television (India); and Dr Tarun Das, Director General, Confederation of Indian Industry, New Delhi. ❑

TRAINING PROGRAMMES

Petroleum Refining Technology

THE Indian Institute of Petroleum (IIP), Dehra Dun, conducts several training courses for petroleum industry officials every year. Recently, the institute conducted a twelve-day training course for senior officers of the Indian Oil Corporation Ltd, on 'Petroleum Refining Technology'.

Inaugurated on 18 November 1996, the course had sessions on basics of crude oils and products and refining process technology, hydrocracking and refining processes in refinery. Co-ordinated by Shri V.P. Sharma of IIP, the course consisted of 31 presentations, four laboratory visits and a group presentation on trouble shooting.

Twenty-one officers from seven IOC refineries in Gujarat, Assam, West Bengal, Haryana and Uttar Pradesh were represented by these trainees.

Dr Himmat Singh, Head of the IIP's Training Division, Dr J.M. Nagpal, Shri S.K. Chhibber made presentations during the programme. Dr B.S. Rawat talked to the participants about aromatics and Shri U. C. Aggarwal apprised them of the latest developments in the field of dewaxing and deoiling.

Among the participants of this course were S/Shri C.S. Sonwal, Y.K. Jha, D.N. Agarwal, P.K. Gogoi, D.K. Sinha and N.K. Diwakar. The training programme concluded on 29 November with a presentation on trouble shooting.

During the valedictory function, Dr T.S.R. Prasada Rao, Director, IIP, stressed the importance of R & D in the petroleum sector, citing the example of multinationals who have huge corporate R & D sectors. He said that the increasing number of refinery executives attending the IIP's training programmes shows that the importance of updating knowledge through such courses was being fully realized by the oil industry in the country.

Shri Manoharan, Chief Production Manager of IOC's Gujarat Refinery was the chief guest at the valedictory function. ❑

Chemical Analysis of Ceramic Raw Materials

THE Central Glass & Ceramic Research Institute's Naroda Centre, Ahmedabad, organized a training programme on Chemical Analysis of Ceramic Raw Materials, during 9 - 19 December 1996.

The nine-day programme comprised theoretical lectures with practical demonstrations on testing of different types of ceramic raw materials like quartz, feldspar, china & ball clays, fire clays, other alumino-silicates and aluminous materials. The course also discussed the various requirements for setting up a chemical laboratory for analyses of the above mentioned raw materials. The trainees were taught preparation of standard solutions, instrumental analyses, complexometric titrations, etc. ❑

CONFERENCE BRIEFS

Dr A.A. Khan

DR A.A. Khan, Head, Chemical Engineering Division, Indian Institute of Chemical Technology (IICT), Hyderabad, attended, the International Conference on Ozone Protection Technologies and the Meeting of Technical Options Committee of UNEP on Solvents, Coatings and Adhesives, held in the recent past at Washington D.C, USA. The conference was organized under the sponsorship of Alliance for Responsible Atmospheric Policy in cooperation with USEPA Environment, Canada and UNEP.

During the conference, six parallel technical sessions were held on various aspects of ozone protection technologies such as alternatives for existing CFC refrigerants for air-conditioning, solvents for processing and cleaning, foams, halons and aircraft manufacture and maintenance.

The seven sessions held on solvents addressed the following principal issues: Users' experience with alternative solvents (3 sessions); and Performance aspects of new solvents (2 sessions).

One session was devoted to evaluation of new clean technologies from Japan and one for future strategies for the solvent sector.

An exhibition was also organized on the occasion, in which materials available for replacement of halons, solvents, refrigerants, etc. were displayed. Several commercial organizations from USA, Europe and Japan participated. Apart from the manufacturers and the trading organizations, US-EPA, UNEP and many NGOs were also present with their literature. ❑

NEW PUBLICATIONS

Challenges in Crude Oil Evaluation

CRUDE oil evaluation studies are of immense importance to petroleum industry (downstream as well as upstream) as the information is required at every stage of crude oil handling and processing. With the technological advancements, the scope and requirements of crude oil evaluation are also increasing. In recent years significant developments have taken place in this area. Advances in analytical sciences are giving valuable support to crude and product analysis.

The book titled *Challenges in Crude Oil Evaluation* has been brought out by the Indian Institute of Petroleum (IIP), Dehra Dun, based on the contributions of various research scientists and professionals from the petroleum industry in the workshop held at IIP last year. The book has been edited by Dr J.M. Nagpal, Head of the Crude Evaluation and Standard Analysis Area, and published by Tata McGraw-Hill Publishing Company Ltd.

Dr T.S.R. Prasada Rao, Director, IIP, in the preface of the book has emphasized the importance of the crude evaluation in taking key decisions in the oil industry.

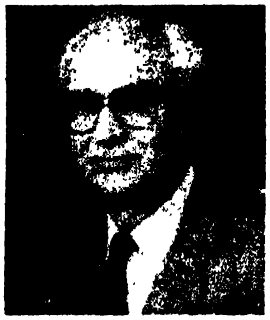
The articles in the book present comprehensive reviews of the state-of-the-art analytical techniques used in crude oil evaluation. Overview of the crude scenario in the country and use of crude evaluation data in product optimization and crude work up as well as valuable analytical results of various crude products and feed stocks have been discussed. Special reference has been made to heavy crude quality and flow behaviour of crude oils.

Evaluation of crude oil is one of the focal activity of IIP and the institute has some of the most sophisticated analytical facilities to generate detailed crude and product analysis data. More than 150 crudes have been analyzed at the institute so far and a comprehensive database on these has been generated. Besides technological services in the form of feed stock and product evaluation and product development are being provided to the petroleum industry regularly. □

HONOURS & AWARDS

Dr T.N. Khoshoo gets Sasakawa Environment Prize

Dr T.N. Khoshoo, ex-Director, National Botanical Research Institute (NBRI), Lucknow, has been awarded the 1996 UNEP Sasakawa Environment Prize. The prize was presented to him at a function held in New Delhi on 30 November 1996.



Presiding over the function, Lord Stanley Clinton-Davis said, "UNEP Sasakawa award is indeed prestigious--reflected not only in the Prize money- but primarily because of the contribution made to the quality of life for the developed and developing world alike, for humanity, for sustaining and nourishing the environment, we hold in trust for future generation."

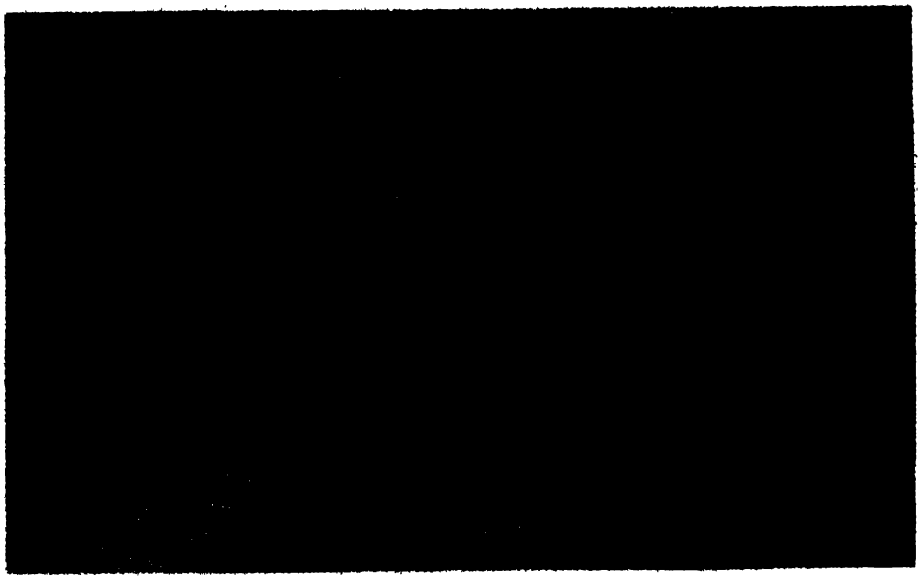
"Our past winners and certainly our winner this year, Dr Triloki Nath Khoshoo reflect these attributes, each in his own unique and enduring way. Dr Khoshoo has demonstrated by his work reputation in the field of cytogenetics and biological diversity how sustainable industrial development and environmental protection can and must be complementary. Indeed, it is ante-deluvian to think of them as being mutually inimical. He has done his distinguished work in the public and private sectors and he has pledged himself to go on pursuing these tasks with dedication to the objectives which have marked out his superb contribution over so many years for the benefit of 'the biodiversity-rich and technology-poor regions' - often performing the impossible. I am confident that his work will continue to be one of the navigational beacons which pierce that fog of indifference or hostility, which still - all-too-often-passes for thought in so much of the industrial and political world."

Addressing the distinguished gathering, Mr Takashi Ito, Manager, Planning and Coordination, Department of International Affairs, The Nippon Foundation (earlier Sasakawa Foundation), observed, "This year's award recipient, Dr Khoshoo, has been an advocate of strong regional environmental planning in the development context for more than thirty years. To this end, he has contributed his considerable knowledge, experience and skill, gained from a long and distinguished career as an eminent scientist, researcher and administrator. These qualities were made more potent by a streak of pragmatism. Despite the tremendous theoretic brainpower at his disposal, manifest in his early successes as a cytogeneticist, Dr Khoshoo did not remain in pure academia and pure research. Instead, he went out and demonstrated a marked ability to get things done, to be an agent of change, which greatly extended his impact, explaining why we are honouring him today. We are confident that his future contributions to global environmental issues will be as substantial as his past achievements." □

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit
Annual Subscription : Rs. 60
Editor : Dr B.C. Kashyap Editorial Assistant : Neelima Handoo Production : Kaushal Kishore Single Copy : Rs. 3.00
Gram : PUBLIFORM Telex : 031-77271 E-mail: niscom@sirnetd.ernet.in. Fax : 5787062

ISSN 0409-7467

CSIR NEWS



IN THIS ISSUE

Leather Technology Mission for Sustainable Development enters Advanced Phase 34

Annual Chrysanthemum and Coleus Show at NBRI 41

PECVD & RIE System for Thin Film Deposition and Patterning of Semiconductor Devices 43

Automatic Withering Control System for Tea Industry 43

Elite *mulethi* (Liquorice) genotype released 43

Conference on Mini Refineries 45

CSIR participates in 'India-Expo'96' at Dubai 46

International Management Development Programme on Operation, Maintenance and Repair of Bio-medical Equipment for the Third World Countries 47

Application of jute geotextiles to control erosion in hilly areas, and ICBP construction in progress in the Himalayan region. A report on R&D activities of the Central Road Research Institute, New Delhi, appears on p 37.

Leather Technology Mission for Sustainable Development enters Advanced Phase

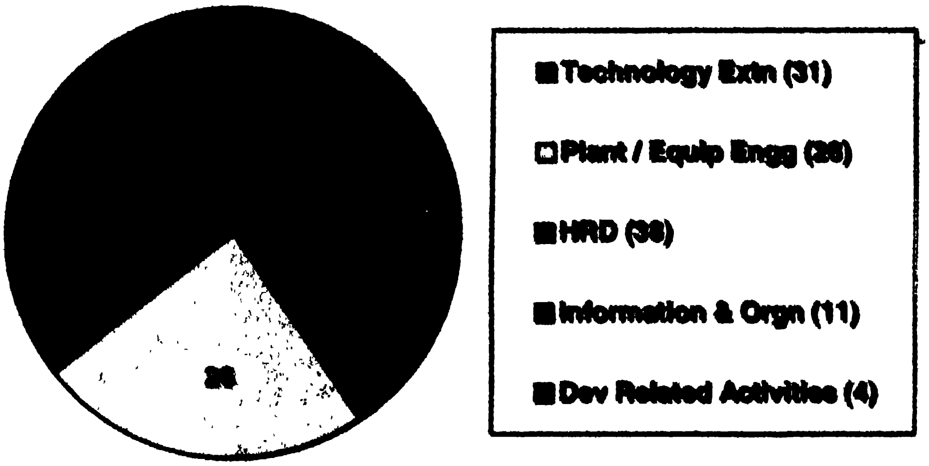
THE Leather Technology Mission (LTM) for Sustainable Development was launched by the Minister of State for Science & Technology on 12 January 1995 at New Delhi with a project outlay of Rs 220 million, including Rs 100 million from the beneficiaries of the Mission. The launching of this Mission was a result of concerted efforts of R&D and academic institutions, state & central government agencies, non-government organizations, industry and other users.

The Council of Scientific & Industrial Research (CSIR) is the lead agency and the Central Leather Research Institute (CLRI), Chennai, a constituent laboratory of CSIR, the implementing institution. This is the first National Technology Mission which is being implemented directly by a scientific institution [*CSIR News*, 45 (1995), 34&46 (1996), 178].

Keeping in view the ready availability of technologies for extension, societal relevance, industrial importance and priority, potential for large-scale impact, environmental and economic benefits and aspects related to sustainable development of the leather industry, five major technology elements with various sub-areas were identified by LTM for implementation:

- Technology Extension
- Plant and Equipment Engineering
- Human Resource Development
- Information and Organization
- Development and Allied Efforts

Quantified targets were set for implementation of Mission mode activities. A target of 125 project activities had been envisaged for a four-year time frame. Within a span of two years, 110 activities have been projectized under LTM, from January 1995 till December 1996.



Total Number of Projects 110

Area-wise projects committed under LTM

MAJOR ACTIVITIES/ACCOMPLISHMENTS

Technology Extension

Four carcass recovery centres one each at Kallupatti (Tamilnadu), Kalyani (West Bengal), Sehore (Madhya Pradesh) and Tranaja (Gujarat) have been commissioned. These are aimed at effective byproduct utilization and carcass recovery. They will function as production-cum-training centres with an overall capacity to process 5000 carcasses/annum and for providing on-the-job training to about 30-40 flayers and local youth.

Implementation of animal health care systems at Gudur for quality improvements in skin of sheep/goat has received appreciation from the Breeders Society. Expansion of this activity to other locations has been sought.

Setting up of demonstration plants for ammonia-free processing and process control systems has commenced in four tanneries located in Uttar Pradesh & Haryana.

Six tanneries, two each at Calcutta, Kanpur and Jalandhar, have been selected for implementaion of chrome management.

Chrome recovery/reuse system is being implemented at eight locations. A chrome recovery system has been commissioned at Ranipet. Chrome recovery/reuse systems ensure 99% recovery and reuse of chromium. The technology requires moderate initial investment and space for plant installation. High exhaust chrome tanning systems present a viable option for overall reduction in chemicals' cost and achieving better environmental benefits.

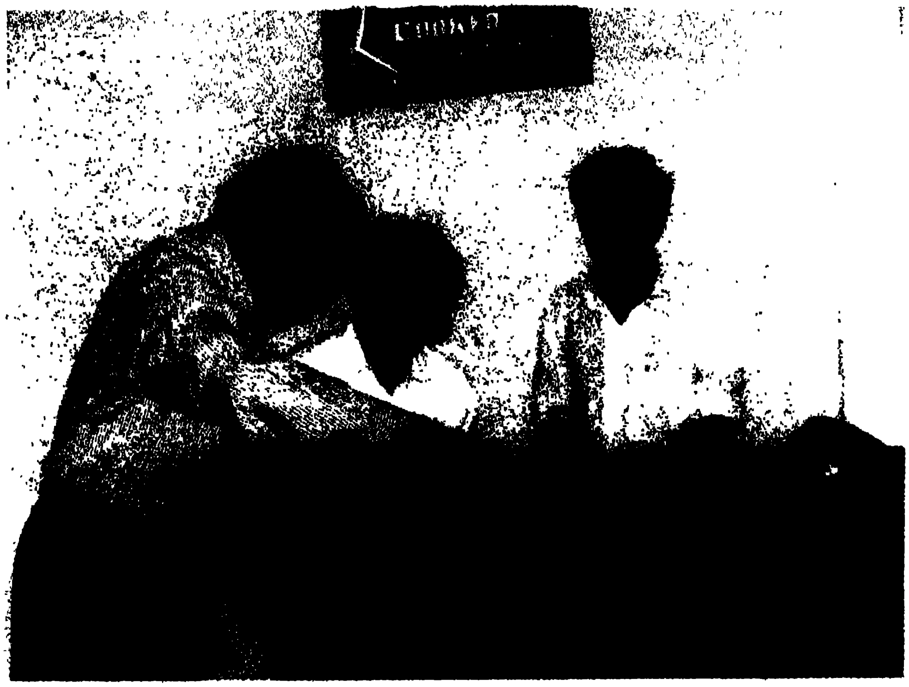
Technology improvisation in conventional system for CETP at

Madhavaram has been provided by CLRI through better aeration design.

Plant and Equipment Engineering

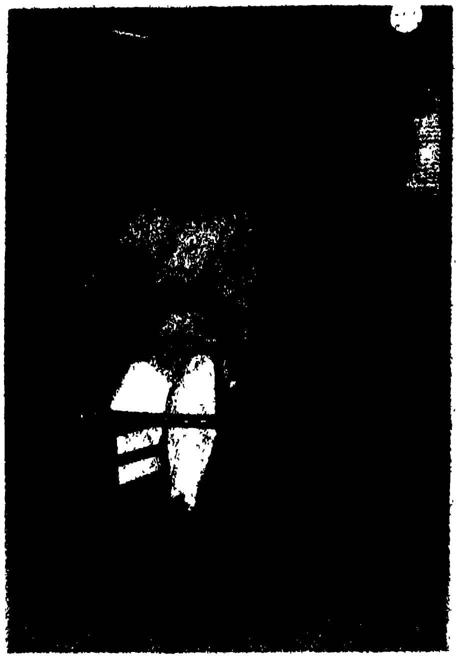
Prototype of add-on facilities (*p*H, water, chemicals) to tannery drums has been completed.

A simple manually operataed drum using fibre reinforced plastic (FRP) to reduce the drudgery of rural tanners has been designed, developed and fabricated by CLRI with a tanning capacity of 2 hides or 20 skins per batch. The technical advantages of such a drum are ease of operation, no electrical power requirement, mobility, and reduction in processing time. Ten manually operated drums have been put to field demonstrations at different locations in various states.



Carcass recovery and byproduct utilization

Air flow drier for drying the minced meat



Manually operated FRP drum with a tanning capacity of 2 hides or 20 skins per batch

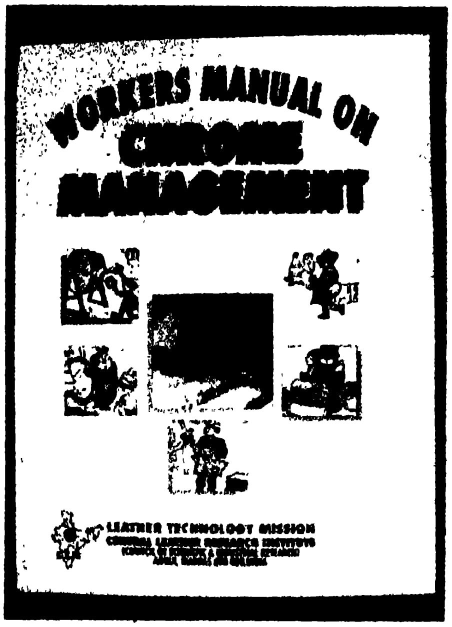
Perspective plan document for development of leather industry in the states of Madhya Pradesh and Rajasthan is under finalization. This plan document will provide information on material scenario, opportunities, future planning including budgetary requirements for development of leather industry in the states.

A pedagogy innovation aimed at providing vocational training for tannery workers has been taken up by CLRI in collaboration with IGNOU.

Human Resource Development

Human resource development activities include development of mass communication aids, preparation of process/quality manuals, and initiation of new training programmes.

Workers innovative manuals on 'Chrome Management', and Carcass Recovery/Byproduct Utilization' have been well received. The first one describes chrome tanning practices in general and highlights the correct methods of tanning and improvements in commercial tanning practices. The second one aims at inculcating good working practices at grassroot level for complete utilization of byproducts, flaying techniques and effective carcass recovery. A Safety Manual has also been prepared for occupational health and environmental safety in leather industry. It provides information on material safety data sheet for about 40 chemicals used in leather industry, correct methods of their handling and hazard potential, storage instructions and safety precautions, etc.


WORKERS MANUAL ON CHROME MANAGEMENT

LEATHER TECHNOLOGY MISSION

Modular training programme with respect to beam house, tanning, wet-finishing and finishing operations in leather processing has been introduced successfully. Training facilities for leather garments and leather goods at Jalandhar, Ahmedabad, Vaniyambadi, Goa, Guwahati, Chittoor, Sirkazhi, etc., are being established. A training facility for footwear has been initiated at Vadodara.

A novel training programme on collection and processing of vegetable tannin materials was conducted for *adivasis*/tribals in the Bastar district of Madhya Pradesh.

Information and Organization

As a part of the information dissemination activities to enable project formulation by tanners in identified areas, workshops have been held for: (i) 'Promotion of modern and eco-friendly technologies' at Warangal, Andhra Pradesh; (ii) 'New developmental concepts for decentralized sector of footwear production' at CLRI; (iii) Short- and long-term strategies for pollution prevention and remediation for North Arcot district' at CLRI; and (iv) 'Modernization and technological upgradation of tanneries' at Kanpur.

A footwear information system has been implemented by INSDOC at Footwear Design and Development Institute, NOIDA. Training-cum- orientation has been provided to the FDDI library staff. A database for leather products on All India basis is being created.

A neighbourhood development programme as technology campaign for artisans engaged in the fabrication of all-leather Kolhapuri footwear has been initiated at Athani, for bringing about quality improvements in leather and leather product manufacture.

Development and Allied Efforts

The recent ban on use of certain chemicals in view of their toxicity has necessitated the establishment of a dedicated laboratory for testing/monitoring the ecosensitive chemicals and for providing pro active response to the industry regarding their replacement and analysis.

An Ecosensitive Chemical Laboratory has been set up at CLRI, Chennai.

Support has been provided under LTM for design & development of specialized footwear for leprosy

Test-rig fabricated by CSMCRI

patients. This has received appreciation from leprosy institutions.

A test-rig has been fabricated by CSMCRI, Bhavnagar, with the LTM support, for control of Total Dissolved Solids (TDS).

The Technology Mission Programme is being executed through a 2-tier managaement system at Advisory and Policy Directive levels. The LTM has devised a number of mechanisms to ensure effective implementation of project activities. These are through Internal Review, Peer Review and Review through the Programme Standing Committee (PSC) and Mission Steering Committee (MSC) of LTM. The Special Monitoring Cells in the Societal & Technology Missions Division at CSIR Headquarters, New Delhi, and at CLRI, Chennai, are assisting the LTM Director in the management of the Mission activities.

LTM is thus set to play a crucial role in balancing development between domestic and export sectors, environment and economics, rural and organized sectors and support employment generation and gender empowerment at grass root level in the leather industry. ☐

CENTRAL ROAD RESEARCH INSTITUTE, NEW DELHI

R & D Highlights: 1995-96

THE R&D programmes of Central Road Research Institute (CRRI), New Delhi, relate to: Geotechnical Engineering; Soil Stabilization and Rural Roads; Pavements; Bridges; Traffic and Transportation including Vehicular Pollution; and Instrumentation, Systems and Computer Software in the above areas. While pursuing its R&D activities, the institute makes all efforts towards transfer of technologies/know-how, providing consultancy, organizing training programmes and harnessing media to ensure wider applications/utilization of its research accomplishments.

During 1995-96, CRRI handled around 30 projects on a consultancy basis and organized several refresher courses and training programmes for in-service highway engineers. The institute's cash inflow through the sponsored/consultancy projects amounted to Rs 14 million during the year.

The R&D highlights:

GEOTECHNICAL ENGINEERING

Design, Construction and Monitoring of Reinforced Soil Wall: The institute carried out studies on design, instrumentation and monitoring of a reinforced soil retaining wall constructed on one of the ramps forming at Visveshvarya Setu on National Highway No.2, in New Delhi. This retaining wall is the first of its kind built in India using high tensile geogrids for the reinforcement and fly ash as backfill material. This technique was adopted, since the conventional retaining wall required acquisition of large area of land which was not possible as the site was located near an industry.

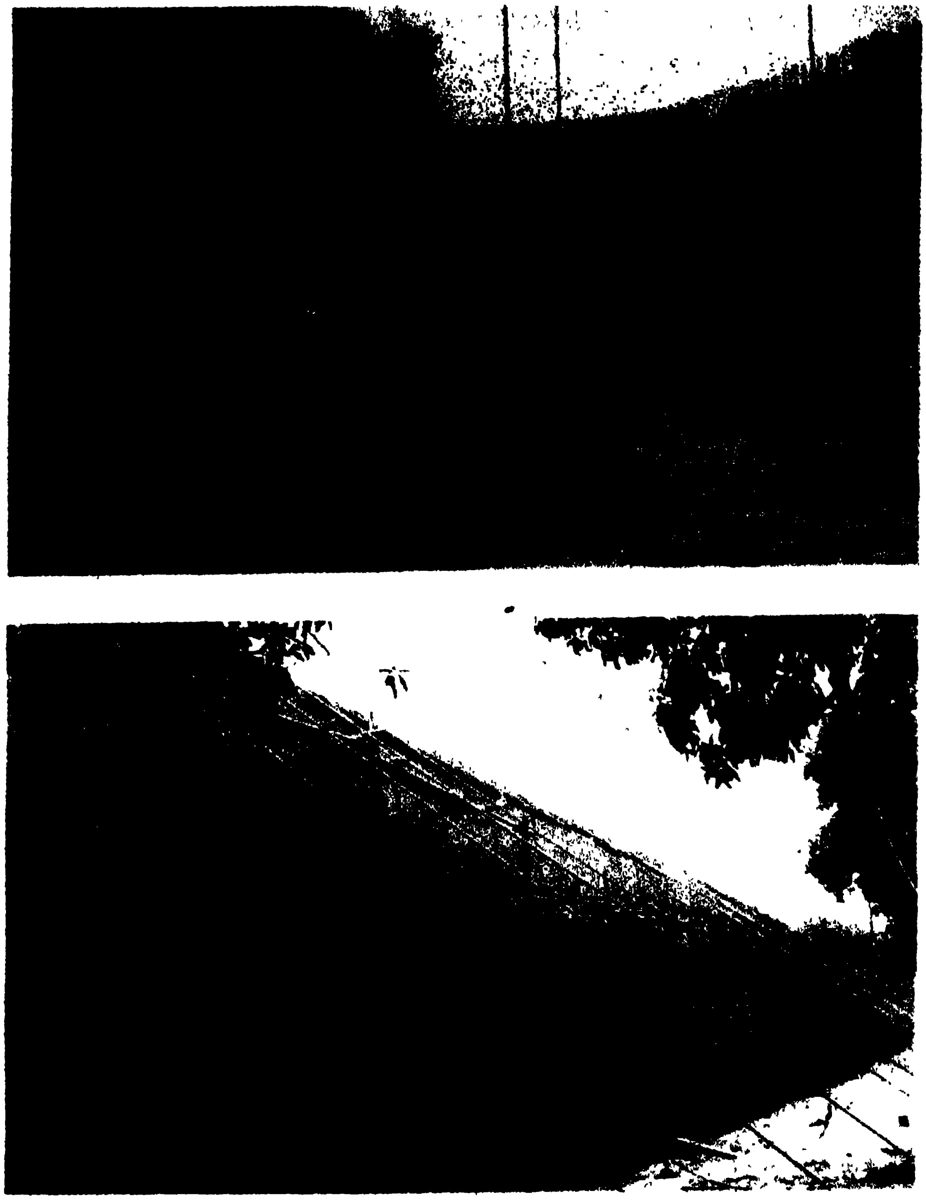
The construction of reinforced soil wall was carried out in three phases: (a) erection of facing panels, (b) spreading and compaction of fly ash as backfill material, and (c) spreading of mono-orientated geogrids. Monitoring work is in progress.

Development and Promotion of Jute-based Geotextiles: Under a project sponsored by the Indian Jute Mills Association, with funding by the Government of India, UNDP and Jute Industries, proposals were made for ground improvement to tackle soft clay problems at Kakinada port, road construction in Kakinada municipal area and pavement drainage application at Joshimath and Mallari road under DGBR area. Specifications of geotextiles for each application area and their quantities were also worked out.

To control erosion, the jute geotextiles have been used at two different locations in Himachal Pradesh on NH-21. Monitoring of these sites is in progress.

Investigations for Strengthening and Improvement of Pathankot-Jammu Road (NH-1A): Investigations were made on the road stretch from Km 72/00 to 90/00 of Pathankot-Jammu Road (NH-1A), for its strengthening and improvement. Based on these investigations, recommendations have been made for strengthening/improvement of the pavement at different stretches of the road. These include raising the level of the embankment and reconstruction of the pavement strengthening of the existing pavement and improvement of drainage.

Analysis and Correction of Landslides on Arnas-Mahor Road, Udhampur Distt. (J&K): The causes of failure of thirteen landslide stretches on Arnas-Mahore Road in Dhampur Distt (J&K) have been investigated and various remedial measures suggested. These include



Construction of fly ash reinforced solid wall for Okhla flyover, and a view of facing panels of reinforced soil wall

effective surface drainage systems, road side drains, breast walls, protection of toe, etc.

SOIL STABILIZATION AND RURAL ROADS

Use of Municipal Wastes in Road Construction: Under a project sponsored by the Ministry of Environment and Forests, specifications were developed using municipal wastes for sub-base and embankment construction. In collaboration with Municipal Corporation of Delhi, a site for construction of the test sections has been selected on Garhi Ridala-Ladpur Road near Garhi Ridala Village.

Use of Granulated Blast Furnace Slag (GBFS) in Road Works: Studies have been made on the use of granulated blast furnace slag, a waste product obtained from Visakhapatnam Steel Plant. Detailed investigations show that GBFS is a suitable material and can be used in the lower layer of pavement.

Technology Mission on Flyash Utilization & Disposal: Under this Mission, the institute was entrusted the task of demonstrating the use of fly ash in construction of roads and embankment. Specifications have been developed and construction work is in progress at one site at Raichur, using these specifications.

Working Manual on Construction and Maintenance of Low-volume Roads: A working manual has been prepared on construction and maintenance of low-volume roads, which provides information on technologies and maintenance management practices of low-volume roads. This document will find use in the rural road development programmes.

PAVEMENTS

Use of Geosynthetic Reinforcing Fabric as Interlayer to Control Reflective Cracking in Bituminous Overlays: Under a sponsored research study of the Ministry of Surface Transport, test sections were laid using geofabric as pavement reinforcing interlayer, to control the reflective cracking in bituminous overlays. Performance evaluation data of test sections indicate that the surfacing is in good condition, better than the controlled sections laid without geofabrics.

Field Trials on Use of Rubber and Polymer-modified Binders in Bituminous Surfacings: This project was also sponsored by the Ministry of Surface Transport. Test track using SBS- and EVA- modified bitumen laid in snow-bound area was found to give better performance than the test tracks laid with conventional bitumen.

Use of Cationic Bitumen Emulsion under Different Climatic Conditions of India: In collaboration with Indian Oil Corporation Ltd and Border Roads Organisation test sections using cationic bitumen emulsions were laid on NH-1A, NH-44(Assam) and Hanuman road. Performance evaluation indicated that emulsions can be used in road construction in varying climatic conditions. The performance of test-sections after three years has been found to be very good.

Magnesium Oxychloride Cement (MOC) Concrete: In collaboration with Border Roads Organisation, a test track with three specifications using MOC in different proportions was laid at Lukransar Sattasar link road in Rajasthan. Performance evaluation has indicated good condition of test-track. Studies on the use of magnesium oxychloride cement concrete in paving concrete has indicated that it can be used successfully as a surfacing binder and also for the construction of concrete roads.

Computer-aided Design for Rigid Pavements: The software programmes for rigid pavements design and cement concrete mix design based on IRC:58 and IRC:44 respectively were developed in Fortran language.

Experimental Evaluation of 'ICBP' Test Section on Snow-bound Road in Western Himalayas: Under a project sponsored by Border Roads Organisation, an ICBP section was constructed in J&K in 1993 and its performance is being evaluated every year during the traffic season. Traffic during summer is of the order of 700 heavy vehicles per day. The performance report of the section for the third consecutive year is very encouraging; as the profile has stabilized and no defects have been reported.

Evaluation of Causes of Damages to Roads in National Capital Territory of Delhi (NCTD): Investigations have been carried out to evaluate the causes of damages of roads in NCTD, under a project sponsored by the Chief Minister of Delhi. Causative factors for present level of distress and recommendations for preventive measures have been suggested.

Pavement Deflection Measurements by Falling Weight Deflectometer (FWD) and Benkelman Beam Under Different Environmental Conditions: To bring out a comparison between FWD and Benkelman beam deflection methods and to study the effect of temperature, subgrade moisture variation and wheel load on material properties, test-sections on NH-1 and NH-2 were identified. A series of periodic measurements were taken. Data collection has been completed and analysis of data is in progress.

BRIDGES

Generation of Optimum Design Curves for Truss-girder Bridges Under Moving Loads: An expert system software which can generate optimum design for cross sections of five type of bridges has been developed. The economy accrued in design of a through type Warren truss-girder and parallel-chord Pratt truss-girder using the software package 'BTEXPERT' developed by the institute is about 40%.

A technology digest on the package 'BTEXPERT' entitled *Expert System for Structural Optimisation of Truss-Bridges* has been prepared for marketing purposes. A PC-based version of the software has also been developed for marketing purposes.

Limit-state Design of Reinforced Concrete T-beam Bridges with Cross-Diaphragms: A method for nonlinear analysis of grillage frame using elasto-plastic idealization of moment-curvature relationship has been formulated. The computer-codification of the method in Fortran 77 is in progress.

Evaluation of Fusion-bonded Epoxy Cement Concrete Structures: Corrosion is a major problem in reinforced cement concrete structures. To combat corrosion in RCC structures, several protective coatings are available, which include cement slurry, phosphate jelly, polymer-based organic and inorganic paints. CRRI has carried out a study on the relative performance of these different protective coatings under field conditions, on sponsor-

Modified Benkelman beam alongwith LVDT

ship from Ministry of Surface Transport. A state-of-the-art report is under preparation, which will provide useful guidelines to the bridge construction industry for enhancing the life cycle of RCC bridges.

INSTRUMENTATION

***Microprocessor-based Nuclear Density and Moisture Meter*:** A collaborative project has been undertaken with ECIL - Hyderabad to develop microprocessor-based nuclear density and moisture meter, under the PASTER programme of DSIR.

Design of nuclear density and moisture meter has been finalized by CRRI and a prototype is under fabrication by ECIL. The instrument will find applications in quality control in road construction.

***Portable Device for Measuring Field CBR of Soils*:** To measure field CBR of soil subgrade, two portable devices have been fabricated. The units have been calibrated for entire range of pavement materials. The device has been patented and ready for commercialization.

TRAFFIC & TRANSPORTATION

***Route Planning and Design for Goods Road Transportation at TISCO Works*:** At the request of Tata Iron and Steel Company, Jamshedpur, a study has been carried out to assess the road transportation infrastructural requirements for the smooth flow of heavy goods vehicles, e.g. truck trailers, at TISCO Works. Based on these studies, proposals for route design for flow of goods vehicles inside the Works, their parking, and widening and improvements of link road from Works to NH-33 have been suggested.

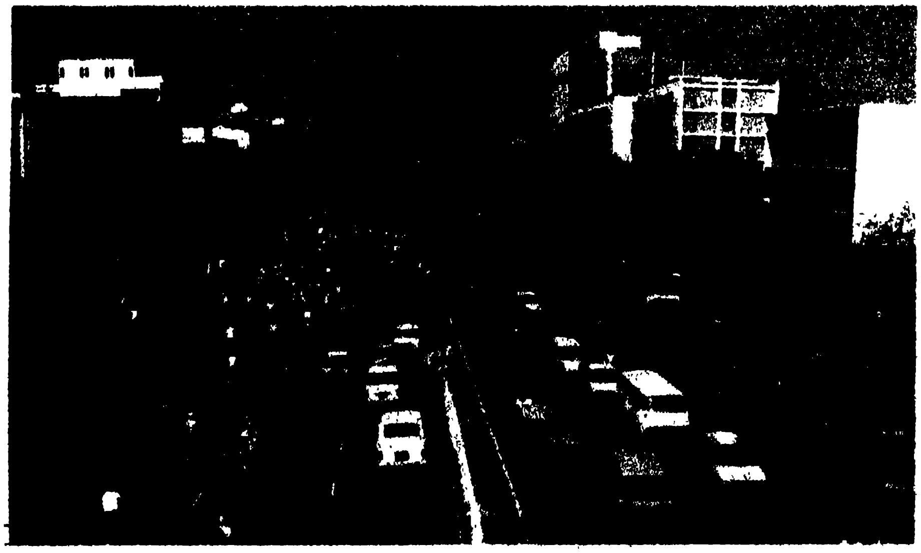
***Traffic Circulation in and Around Kashmiri Gate, Delhi*:** At the request of ISBT management and PWD, Delhi Administration, studies were taken up to prepare a circulation plan for buses at ISBT, and to assess the pedestrian and traffic related problems and suggest measures for improvement. Based on data analysis, two alternative circultion plans have been evolved.

***Jaipur Urban Mass Transport Study*:** Jaipur Development Authority (JDA) entrusted to the institute an assignment to assess the requirements of mass transport in Jaipur and solve the increasing problem of road transportation in the city. The study involved assessing the travel demand, socio-economic benefits, travel characteristics, development of transport models and identification of travel corridors. Based on the field surveys, it has been recommended that light rail transit would be the most appropriate mode of transportation.

Another study entrusted by JDA to the institute related to formulation of car parking policy and transportation management of the walled city of Jaipur. The study included assessing the current and future demands and suggesting management measures. The study has been completed; the recommendations made will help decongest the city traffic and regulate the entire transportation.

***Traffic Management Plan of Parivartan Chowk, Lucknow*:** At the request of PWD, Lucknow, a study was taken up to find out the most appropriate design for Parivartan Chowk, an important intersection in Lucknow. Based on the existing traffic scenario, and taking into consideration the projected traffic needs for future, a traffic management plan has been recommended giving short-term and long-term proposals.

***Primary Road Network for Tuticorin Port*:** At the instance of Tuticorin Port Trust, a study has been made for preparing development plans for the primary road network for quick and efficient disposal of road freight. The study has come out with specific recommendations with regard to the development of primary road network in the region of Tuticorin Port and several proposals for the general improvement of traffic circulation in the vicinity of the Tuticorin Port Trust.



Traffic scene at intersection on a Delhi road

Vehicular Pollution Load in Metropolitan Cities in India: Studies made by the institute have shown that among the five metros, the vehicular pollution loads are maximum in Delhi (1430 IPD) followed by Mumbai. Maximum increase in pollution has been observed in Chennai, followed by Calcutta during 1993 over base year data of 1990. However, decrease in Mumbai (-16%) has been found to be inexplicable and contrary to trend.

Hoardings— A Threat to Road Traffic Safety: Hoardings displayed on the roadside are expected to be environment-friendly, and not a safety hazard. A study carried out, in Delhi indicates that compliance of rules and regulations regarding hoardings is almost nil. The violation also poses threat to asthetic appearance of capital.

Software for Simplifying Traffic Study Procedures: A software has been developed to simplyfy traffic survey procedures. It processes traffic on real time basis using in- built clock system.

Pavement Performance Study: Based on a study conducted on an existing pavement section, the software package 'PDM' has been modified to accommodate the rate of traffic growth. The package gives output of pavement deterioration over time in terms of different modes of distress.

In order to adopt Highway Design and Maintenance standards model HDM III developed by World Bank, the calibration of Road Deterioration and Maintenance sub model is in progress. Review of the scope of a study on new pavements sections is being carried out.

ROAD SYSTEMS AND SOFTWARE

Priority R&D Needs of the Road Sector: To identify the priority needs of this sector, a symposium by correspondence was organized on 'What India Needs to Do in the Road Sector: Some Top Priority Issues'.

A concise document to serve as a resource reference for future R&D Planning in the country has been prepared for inclusion in the Ninth Five Year Plan.

National Accelerated Loading and Pavement Test Facility: The institute has prepared a detailed project report on establishing a national accelerated loading facility for consideration of the Ministry of Surface Transport. An outline 10-year plan of work and an action plan for keeping the facility fully utilized with high priority R&D studies has been drawn up. For further follow-up, a separate group has been set up at the institute.

GLOBALISATION

World Interchange Network (WIN) Node at CRRI: The World Road Association (formerly PIARC) has formally launched the World Interchange Network (WIN) at its Annual Meeting held at Montreal in September 1995. CRRI has started functioning as WIN node. The first bulletin of WIN has been brought out in April 1996. It will help users to exchange road related information and technology globally. ❑

Annual Chrysanthemum and Coleus Show at NBRI

THE most colourful event of the year, i.e. the two-day Annual Chrysanthemum and Coleus Show of the National Botanical Research Institute (NBRI), Lucknow, was organized by the institute on 7-8 December 1996 at its Central Lawn. A large number of Chrysanthemums--potted as well as cut floweres, large and small flowered and arrays of Coleuses in their multiple hues and shades, vying with each other for their intrinsic beauty were displayed. The show was categorized in seven main classes and 123 sections for the competitors and was open to government, semi-government, autonomous bodies and nurserymen. Besides, some sections were open to all and some to restricted individual groups of ladies. The show attracted a total number of 1170 entries from 120 competitors. This year, three new running challenge trophies, in addition to existing 15 running challenge cups, shields, and trophies and 385 other prizes, were awarded to the successful competitors.

There were many attractive thematic arrangements on issues like environment pollution, population control, partriotism and even lines from filmy songs. These included: 'Save Our Planet, Stop Pollution', 'Arrival of Spring', 'Herbingers of Peace', 'Ideal Friendship', 'Roop Suhana Lagta Hai', 'Smile', 'Unity is Strengh', etc.

Shri Mehmood Ahmad of Shahjahanpur, and Assistant Engineer (H.Q.), U.P. State Electricity Board, Lucknow, were adjudged as the most successful exhibitors, each bagging three running challenge trophies/cup. Ranjit Singh Memorial Trophy for the 'King of the Show' and Ram Kishore Sharma Memorial Trophy for the flower of the year 'Autmun King' were lifted by Shri Mehmood Ahmad of Shahjahanpur, while Smt. Ranjit Singh Memorial Trophy for the 'Queen of the Show' was awarded to Smt. K.P. Srivastava, Mahanagar, Lucknow.

Some of the R&D accomplishments of the institute highlighted through the display were;

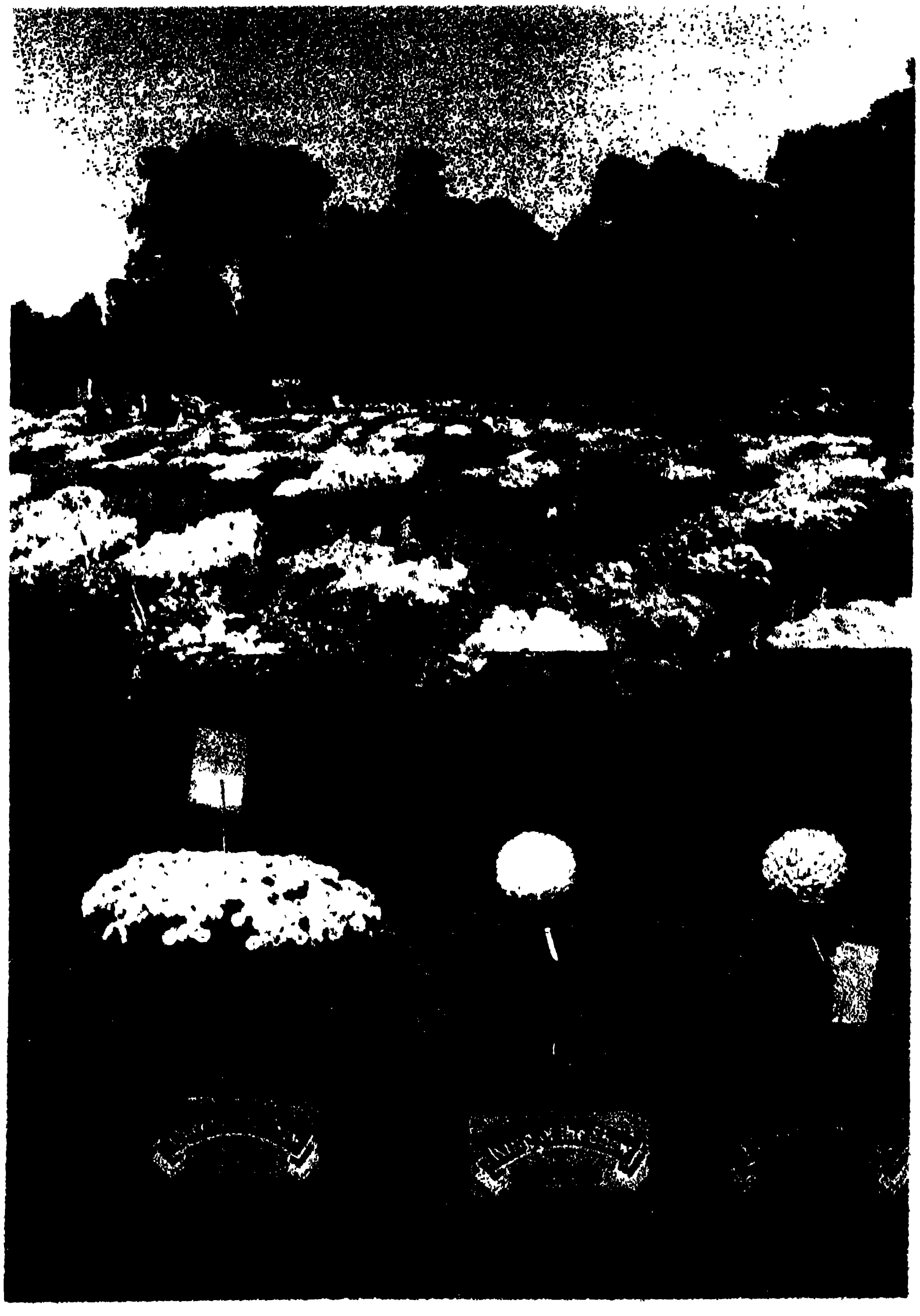
1. Improved Chrysanthemum varieties developed during the last few years, including the 'No Pinch No Stake' mini chrysanthemum varieties.

2. Different floral art prepared by training chrysanthemum, like, 'Sen Rin', 'Tsukuri', 'Cascade', etc.

3. The contrast in the Chrysanthemum with regard to plant height, bloom size, bloom colour, floral shape and their arrangements.

4. Some newly acquired uncommon cultivars of exhibition type large flowered chrysanthemum and some of the gamma-ray induced mutants, namely 'Man Bhavan', 'Shabnam', 'Sheela', 'Navneet', 'Batik', 'Subarna', 'Shyamal', etc.

5. Dehydrated flowers in glass containers for interior decoration.



A view of the annual chrysanthemum and coleus show'96 at NBRI, and prize-winning chrysanthamums

A special attraction of this year was the use of minichrysanthemums in landscaping. A map of the India has been created in the NBRI Garden using different types of minichrysanthemums. Wide array of different colours of chrysanthemum were used in the formation and demarcation of different states, indicating the diversity of its people, language, etc.

The prize distribution function which was attended by a large gathering was presided over by Lt. Gen. Chandra Shekhar, G.O.C.-in-Chief, Central Command, Lucknow. Smt. Aruna Shekhar gave away the prizes. Lt. Gen. Shekhar eulogized the efforts of NBRI in the field of floriculture. ❑

PECVD & RIE System for Thin Film Deposition and Patterning of Semiconductor Devices

PLASMA Enhanced Chemical Vapour Deposition (PECVD) and Reactive Ion Etching (RIE) processes are widely used for thin-film dielectric layers (silicon nitride/silicon oxy-nitride) deposition and patterning of the semiconductor devices.

The National Physical Laboratory (NPL), New Delhi and the Central Electronics Engineering Research Institute (CEERI), Pilani, have jointly designed and fabricated a Multizone PECVD & RIE system, using indigenous as well as imported components. The system consists of two stainless steel chambers, one for PECVD and the other for RIE. In addition, it has a load lock for loading and unloading the substrates without exposing the process chamber (PECVD or RIE) to the atmosphere. The substrates can be transported to the individual process chamber by using magnetic arms. Turbo-molecular and rotary pump stack has been used for pumping the chambers, and base pressure of 10^{-6} torr has been achieved. The flow rate and pressure of process gases (NH_3, SiH_4, N_2O and CF_4/O_2) can be adjusted by using the mass flow and throttle valve controllers and the gases are exhausted through a scrubber. Special interlocks for failure of water in turbo-pump, nitrogen supply in the rotary pumps have been provided for operational safety.

The PECVD/RIE system has been installed at CEERI, and the processes for the deposition of silicon nitride, oxy-nitride and reactive ion etching have been optimized. These processes are being used for the fabrication of III-V compound semiconductor based microwave/opto-electronic devices. ❑

Indigenous PECVD/RIE system installed at CEERI

Automatic Withering Control System for Tea Industry

THE computer-based measurement and monitoring system for the withering process in tea industry, successfully commissioned earlier by the Central Electronics Engineering Research Institute (CEERI), Pilani, at the Gulma Tea Estate, Siliguri, has been upgraded by the institute by incorporating an automatic withering control. The system monitors the process parameters such as leaf moisture, leaf-bed temperature and RH of ambient air and controls the hot or normal air flow through the withering trough. The control software can be configured according to the factory demands like required percentage wither or percentage moisture content, withering time, moisture profile to be tracked, etc. The system has been tested in the commercial manufacturing set-up and has been working satisfactorily under different environmental conditions. ❑

Elite *mulethi* (Liquorice) genotype released

CULTIVATION of *mulethi* (*Glycyrrhiza glabra*) is limited to countries like UK, USA and erstwhile USSR. Owing to continuous decline in the area under cultivation, the plant needs immediate conservation strategies. In India, the plant is being cultivated in the northern parts, but its commercial cultivation has not been possible so far and the domestic requirement is met through imports.

The dried rhizome and root of *G. glabra* is commercially known as liquorice which is used as flavouring agent and taste coorigent in pharmaceutical and confectionery industries. Rhizome of liquorice is soft, flexible and fibrous with light yellow colour and a characteristic sweet taste. Luqiorice and its products are widely reported to be useful in ulcer therapy. Glycyrrhizin, a triterpene glucoside, is the principal constituent of liquorice which is 50 times sweeter than sugar.

G. glabra is a self pollinating species (2n=16) and is harvested for its rhizomes and roots in early winter season after the crop attains the age of 1.5 to 3 years. The planting which generally takes place during January-March, can be done from cuttings obtained from the stolons of the field grown plants. However, only 15-20 cuttings can be obtained from one stolon in three years, of which only 40-50% cuttings get established under field conditions. Therefore, the tissue culture technique has now been perfected to obtain large number of planting materials in a short span of time. A stem cutting bearing one or two axillary buds cultured on defined nutrient medium can give rise to more than one thousand true type tissue cultured plants in about six months time.

Genetic studies on *G. glabra* are being carried out at the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, for quite some time, and a promising elite genotype has recently been identified. The cultivar is christened as *Mishree* and has been released for commercial cultivation. It is envisaged that the net profit of cultivation of the crop (atleast three year old) can go up to Rs 112,000 per hectare from marketing of shade dried roots. ❑

Iron as a Battery Electrode

SHRI P. Periasamy, Scientist, Central Electrochemical Research Institute, Karaikudi, has studied the performance of iron as a battery electrode in alkaline solution. He took two types of electrodes, viz. sintered (porous iron and activated) and pressed (iron with iron oxide) in 5.35 M KOH + 0.65 M LiOH, in the absence and presence of 0.05 M thiourea, 0.025 M EDTA, 0.01 M hexamine and 0.01 M sodium sulphide and determined their electrochemical parameters by cyclic voltametric and chronopotentiometric techniques. SEM and XRD were used to study the morphology of surfaces of changed and discharged iron electrodes. Activated (Fe + Cu + Hg + S) electrode in 5.35 M KOH + 0.65 M LiOH + 0.01 M Na$_2$S electrolyte solution gave the best performance.

Left: Glycyrrhiza glabra var. Mishree in the field with exposed roots, *Right top*: Commercial roots obtained from var. Mishree and *Right bottom*: Longitudinal section of root portion showing presence of glycyrrhizin confined mostly to the yellow region.

These were charged and discharged at C, C/2 and C/4 rates.

Based on the above studies, carried out under the supervision of Dr S. Venkatakrishna Iyer, Head, RT Lab, CECRI, Shri Periasamy was awarded Ph.D. degree by Alagappa University, Karaikudi. ❑

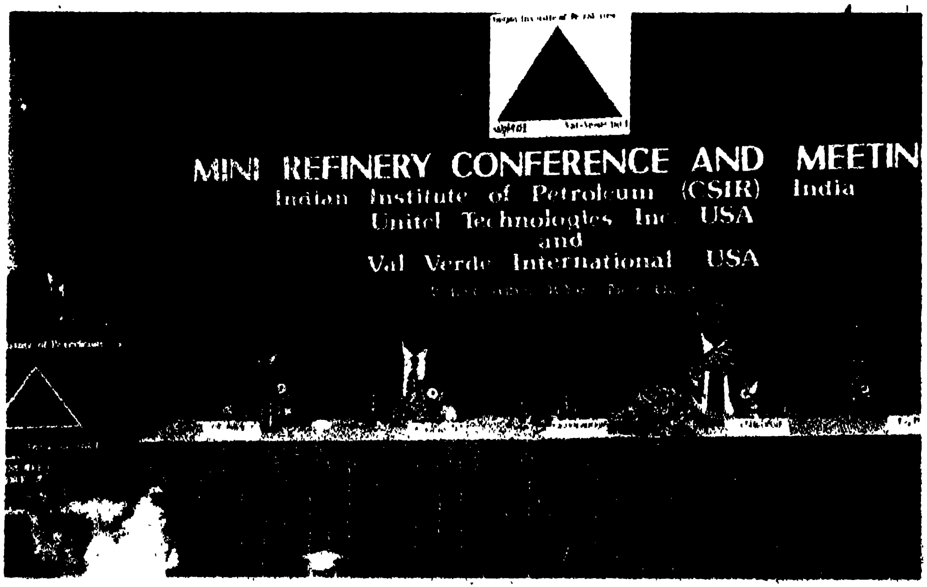
IIP-UTL Tie-up

Conference on Mini Refineries

A one-day conference and meeting on 'Mini Refineries' was organized by the Indian Institute of Petroleum, Dehra Dun, on 5 December 1996 at Hotel Hilton, New Delhi. The conference was attended by potential clients from oil industry and several business houses for gathering detailed information about the mini-refinery concept which is novel to India.

A crucial tie-up was finalized recently between IIP and the Illinois-based Untel Technologies Inc. (UTL) to set up mini- refineries. Both IIP and UTL will provide basic engineering packages and technical services necessary for setting up mini- refineries in India and neighbouring countries on a turnkey basis by involving Val Verde International, USA, who are world leaders in setting up mini-refineries of modular design.

Mini refineries are designed to process 0.05-0.5 million tonnes of crude per annum (100 - 10,000 barrels per day). The total investment is low and it has a very quick pay-out period. The mini refineries can be installed on turnkey basis and crude in remote areas can be processed at the spot to meet local demands for gasoline, kerosene, diesel and fuel oil. This saves the high cost involved in transporting the crude to bigger refineries. Several of these are operational in US, Russia and West Asia.


MINI REFINERY CONFERENCE AND MEETIN
Indian Institute of Petroleum (CSIR) India
United Technologies Inc USA
and
Val Verde International USA

Dr T.S.R. Prasada Rao, Director, IIP, welcoming the participants to the conference on Mini Refineries. Seated on the dais (from left): Shri S.K. Jain, Shri Ravi Randhawa, Shri Surjit Randhawa and Shri K.G. Mittal

It will primarily be the responsibility of the customer to identify the potential crude oil, its assured supply, location and configuration of the mini-refinery; IIP will extend its services, assay the crude and carry out feasibilty studies as IIP has good database and knowledge of various Indian and imported crude and has expertise in assying crude and carrying out techno- feasibility studies.

Speaking on the occasion, Dr T.S.R. Prasada Rao, Director, IIP, pointed out that petroleum resources in India should enable the setting up of about half a dozen mini-refineries in various parts of the country. He said that this mini-refinery concept is particularly suited to crudes from Assam (North-east in general) Gujarat and Godavari basin. A mini-refinery becomes an attractive proposition where, besides problems of supportive infrastructure, the ratio of oil to gas from a field is low for a bigger refinery to be economically viable even though the crude itself may be of excellent quality.

Shri K.G. Mittal, Officer on Special Duty, is Incharge of the mini-refinery project at IIP, for marketing and setting up of mini-refineries in India and neigbouring countries.

Shri K.G. Mittal and Shri S.K. Jain, Scientists of IIP, Shri Surjit Randhawa and Shri Ravi Randhawa of UTL made presentations on the various aspects of mini-refineries at the conference. ❑

NAL-UNI Lecture Series

Finite Element Analysis: Principles and Practice

THE NAL-UNI Lecture Series made a comeback on 18 December 1996 when the ninth course on 'Finite Element Analysis: Principles and Practice', opened at the TS Seminar Hall of the National Aerospace Laboratories (NAL), Bangalore. The course faculty included Dr G. Prathap (Course Coordinator), Dr Aruna V. Murthy and Dr S. Rajendran from NAL's Structures Division together with Prof. B. Dattaguru, IISc, Bangalaore and Dr S. Gopalakrishnan, IIT, Madras. Twenty-four participants from 10 establishments in the country (including CSIR, ISRO and DRDO constituents, educational establishments and private software houses), attended the 3-day course which also included tutorials and hands on experience on NAL's finite element package 'FEPACS'.

Welcoming the participants to the course, the NAL's Director Dr T.S. Prahlad said that he was delighted that the Series was being revived. "NAL is involved in a large number of high technology projects which have very valuable spin-offs. We see the NAL-UNI Lecture Series as an opportunity to share our experiences in such projects and promote possible spin-offs".

The welcome function also included a brief introductory speech by Shri C.G. Shah, Acting Head, Structures Division, who traced the history of the involvement of NAL's Structures Division in finite element analysis "starting from the time we prepared program paper tapes". ❑

CSIR participates in 'India-Expo'96' at Dubai

THE Council of Scientific & Industrial Research (CSIR), New Delhi, participated in India-Expo'96, the Indian Trade Exhibition held in Dubai during 7-11 December 1996. The exhibition was organized by India Trade Promotion Organization (ITPO), New Delhi. CSIR technologies put on display were from CSMCRI, CDRI, CIMAP, CSIO, IIP, CEERI, NISCOM, CLRI, CGCRI, etc. People in thousands, mostly traders and entrepreneurs, visited the CSIR exposition and evinced keen interest in the technologies on display. The exhibition was well organized and the viewers were explained the technologies in detail by Shri T.D. Nagpal, Head, Unit for Science Dissemination, CSIR.

The technologies which evoked tremendous interest among the visitors relate to: herbal mosquito repellent, isabgol palatable herbal laxative, memory enhancer, aromatic & medicinal plants, industrial burner, computer, servo baby incubator, computer- controlled drip irrigation system, zeolite detergent powder and leather chemicals. Other important participants to the exhibition included major Indian companies/corporations such as TATA, KLM, ITDC, Godrej and SAIL.

A few of the contact persons, companies, the CSIR technologies in which interested and the institutes which developed the technologies are as follows: Sathi Kumar PP, P.B. No. 23366, Dubai, Memory Plus, CDRI; V. Sivaraj; General Manager, M/s Rafisons Pvt Ltd, Dubai, Herbal Mosquito Repellant, CIMAP; R. Rangarajan, Group Manager, (HRD & Trg.), M/s Bhatia Brothers L.L.C., Dubai, Herbal Mosquito Repellent, CIMAP; Bhaskar Banerji, Manager (Planning & Coordination), M/s UNISTAR International L.L.C., Dubai, Krack Cream and Mosquito Repellant CIMAP and Memory Plus and Isabgol, (CDRI); Abid Hussain Shakit, Manager, M/s IBN Rushd Medical Drugs & Equipment Store, Sharjah, Memory Plus CDRI and Krack Cream, Mosquito Repellant, Isabgol - Palatable, Herbal Laxative, CIMAP; John Bailey MCIM, Founder Director, M/s The Perfumers Guild Ltd. 61 Abbots Road, Abbots Langley Hertfordshire WD 5 OB5, UK, Aromatics Perfumers, CIMAP and CSIR Complex, Batra Syed Khalil, M/s Jastammal National Co Ltd, Dubai, Memory Plus, CDRI; Mubarak Ali, Proprietor, M/s Pak Arab Narseries, Dubai, Mosquito Repellant, CIMAP; M. Tariq Barlas, General Manager, M/s The International Electrical Products Co., Dammam, Saudi Arabia, Memory Plus, CDRI; M/s Siva Computer Services, Dubai, Anees Ahmed, Director, M/s Everest General Trading, Umm Al Quwain, UAE, and Nilesh J. Vadhani, Managing Director, M/s Bin Fazal Trading Co., Dubai, Abdul Rehman, General Manager, M/s AL Kimya International, Sharjah, Leather Chemicals, CLRI; Dr Shams M. Alhabbub, Technical Director, M/s Bayouni Trading Co. Ltd, of Saudi Arabia, Chemicals & Pharmaceuticals, IICT; A.V. Ramesh, MGE, Coordinator, P.B. 11072 Dubai, Servo Baby Incubator, CSIO; C.A. Mazeed, Director, M/s Starlight

General Trading, Dubai. Syed Noorul Ameen, Manager, (Business Development), M/s AL Darmaky, AL AIN; Mosameh Ahmed Al Arabid, General Manager, M/s Mosameh Alarabid Trading Est Abu Dhabi; Mohd. Farah, Manager, M/s Daallo Trading Co. Dubai, Bhaskar Banerji, Manager (Planning & Coordination), M/s UNISTAR International L.L.C., Dubai, Mohid Soetr, Manager, M/s Kalat Agri & Fertilizer Est, Dubai, and P. Narasimhan, Marketing Manager, M/s Jalil Industries, Bahrain, computer-controlled Drip Irrigation System, CEERI; Sameet Chheda, M/s Omni Chemical Industries, Detergent Zeolite Powder, CSMCRI; M. Tariq Barlas, General Manager, M/s. The International Electrical Products Co., Saudi Arabia, Mohd. Farah, Manager, M/s Daallo Trading Co., Dubai, Sadanand Tavakari, Mechnical Engineer, M/s Steelmakers & Gulf Inc., Jebel Ali, Dubai, and B. Lal, Production Manager, M/s Automotive Ancillaries Ltd, Dubai, Industrial Burner, IIP. ❑

International Management Development Programme on Operation, Maintenance and Repair of Bio-medical Equipment for the Third World Countries

THE fourth International Management Development Programme on Operation, Maintenance and Repair of Bio-Medical Equipment for the Third World Countries was conducted by the Central Instruments Organisation (CSIO), Chandigarh, at Delhi, Jaipur and Chandigarh from 28 October to 20 December 1996. Attended by 33 international delegates from as many as 16 countries' the eight-week programme was sponsored by the Ministry of External Affairs, Government of India, under the 'ITEC/SCAAP Programme'. The countries represented include Thailand, Syria, Mangolia. Sudan, Tanzania, Yemen. Ukrain, Lao PDR, Vietnam, Romania, Mauritius, Indonesia, Botswana, Zimbabwe, Sierra Leone and Armenia.

Prof. V.K. Kak, Director-Principal, Government Medical College, Chandigarh addressing the participants during the valedictory function of the International Management Development Programme

During the programme CSIO made all out efforts to give broad overview of a fairly large spectrum of medical instrumentation used in various specialities of medicine. The schedule included lecture sessions covering basic principles, operation and applications; hands-on-sessions involving real life repair & maintenance problems of different types of medical instruments; and study tours and visits to medical institutions, state-of-art diagnostic facilities and industries.

The delegates spent three weeks in Chandigarh. The aspects covered here included: Medical imaging covering X-ray, CT scanning, MRI and ultrasound imaging, Instrumentation for neo- natalogy, Neurology and cardiology; Dental equipment, Ophthalmic and endoscopic instrumentation, Instrumentation for cancer therapy as also for nephrology.

The hands-on sessions included repair and maintenance of equipment such as X-ray equipment, ultrasound scanner, diathermy machines, dental equipment, RF generator, optical & ophthalmological equipment, ECG mechine & ECG simulator, analytical instruments, safety analyzer, colorimeter and cardiotochograph, pulse oximeter, drug infusion pump and computers.

Visits were arranged to: 'Allengers Medical Systems', Dera Bassi —

manufacturers of medical X-ray equipment; General Hospital, and Government Medical College, Chandigarh, Departments of Radiodiagnosis, Paediatrics, Cardiology, Ophthalmology, Gastroentrology, Radiotherapy, Dentistry and Nephrology in PGI, Chandigarh. PGI also helped by providing faculty and extending instrumental facilifies. A visit was also arranged to 'Body Visions', SAS Nagar for MRI, 'Recorders & Medicare' Ambala — manufacturers of Neurological Equipment, Instruments and Chemicals and IDDC, Ambala — a centre under HARTRON having contemporary facilities in instrument design and development.

Prior to this, the delegates spent four weeks in Delhi followed by a study tour to Agra and then a week at Jaipur, where the topics covered included lab equipment, viz. RF diathermy and electro-surgical units, spectrophotometers, basic ultrasonics, and video systems. Sessions were held on test & measureing instruments & calibration, bio-sensors, flucosemeters, blood cell counters, retenoscopes, spectrophotometers, ultrasonic nebulizers, colorimeters, incubators, autoclaves and sterlizers, centrifuges, flame photometers, *p*H meters, microscopes, electrophoresis, auto analyzer and blood gas analyzer.

In Delhi, they also had study tours to RML Hospital, NPL, AIMIL, IIT, CSIR Centre of Biochemical Technology, Ranbaxy, BPL, ERTL, Bhushan & Bhushan and Medicare Industries.

In Jaipur, they were taken to Santokba Ji Duriabh Ji Memorial Hospital, Soni Hospital, REIL, and to the Artifical Limbs Centre (famous for *Jaipur Foot*).

The management aspects related to: international guidelines/standards on maintainability, safety and reliability; maintenance & repair centres in hospitals; maintenance management of health care equipment, establishing a repair & maintenance centre, and safety aspects in bio-medical instrumentation.

Beginning March 1994, the four programmes organized by CSIO so far have enabled the institute win world wide acclaim. The success of the programmes can be judged from the fact that the response from Third World countries has been going up and this time there were 33 delegates. The Ministry of External Affairs has identified CSIO as a permanent venue for programmes of this nature.

Prof. V.K. Kak, Director-Principal, Government Medical College, Chandigarh, was Guest of Honour at the valedictory function. In his address, he stated that maintenance of medical equipment was a big problem in developing nations since sufficient manpower was not available to undertake repairs. The problem is becoming more pronounced with technological advances in medical instrumentation. PGI and the Medical College have lot of sophisticated equipment bought at a high cost. The suppliers do not bother about the maintenance once the warranty is over. In such situations, institutions like CSIO have an important responsibility to shoulder. He emphasized the importance of training programmes such as the present one, because besides promoting interaction with other countries, these help in two way dissemination of knowledge.

Earlier, Prof. K.R. Sarma, Director, CSIO, highlighted the magnitude of the maintenance problem. Prof. Sarma brought out that maintenance of instruments was turning out to be a big business and CSIO is trying to play an important role by creating a cadre of entrepreneurs in the area. In this regard, the Department of Science & Technology, Government of India, has already identified CSIO as a nodal agency to conduct such programmes all over the country. CSIO has already conducted three programmes in Jaipur, Bhopal and Chennai. The programme in Trichirapalli in down south has just taken off while programmes in Gauhati. Bhubaneswar and Mysore are going to be held in the near future, he added. ❑

NEW PUBLICATIONS

Flora of Orissa

PUBLICATION of the book on *Flora of Orissa*, in four volumes, has been completed by the Regional Research Laboratory, Bhubaneswar, and thus the much felt need of a comprehensive publication on flora of Orissa has been fulfilled. The book deals with the systematic account of 2727 species of Angiosperms, Gymnosperms and Pteridophytes.

H.O. Saxena and M. Brahmam, Regional Research Laboratory, Bhubaneswar 751 013 and Orissa Forest Development Corporation Ltd. 1994-1996. Pp. I-LXIV+1-2918; 1 map and 75 plant drawings. Price Rs 800 per set of four volumes

Copies available on sale with the Divisional Manager, Plantation (A) Division, Orissa Forest Development Corporation Ltd, Plot No.217/218, Satya Nagar, Bhubaneswar, Orissa. ❑

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr.K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit
Annual Subscription : Rs. 60
Editor : Dr B.C. Kashyap   Editorial Assistant : Neelima Handoo   Production : Kaushal Kishore   Single Copy : Rs. 3.00
PUBLIFORM   Telex : 031-77271   E-mail: niscom@sirnetd.ernet.in.   Fax : 5787062

ISSN 0409-7467

[illegible]

CSIR NEWS

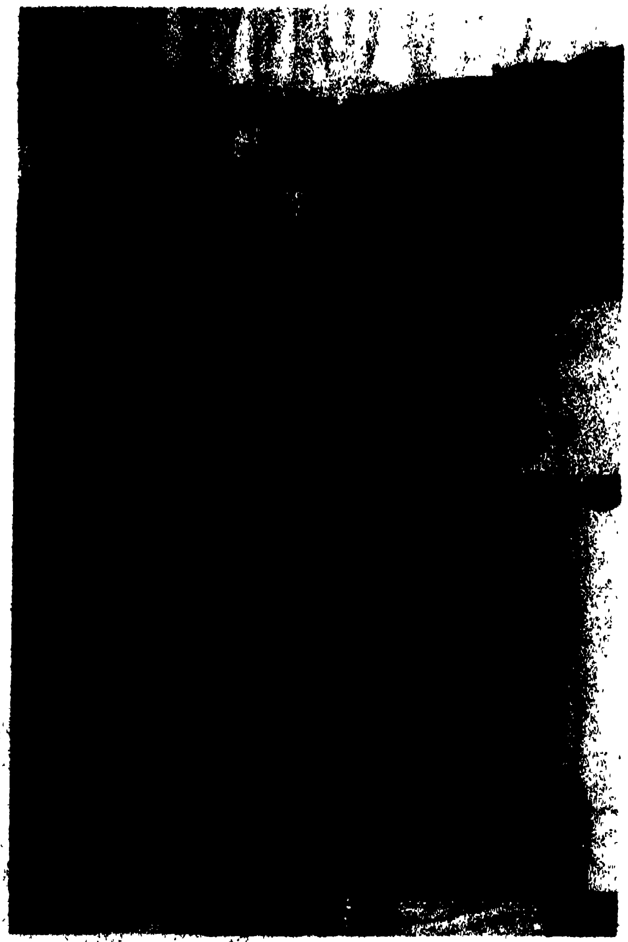
Fiftieth Foundation Day

CBRI enters into Golden Jubilee Year

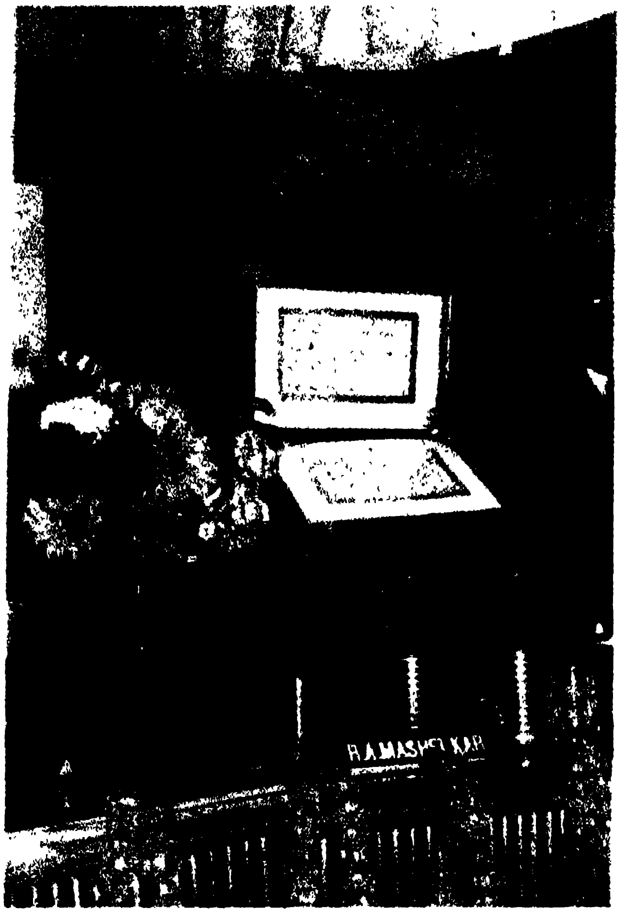
FROM a humble beginning in 1947, the Central Building Research Institute (CBRI), Roorkee, has come a long way to become a premier institute in building research in the country. Its R&D programmes today encompass all aspects of architecture and shelter planning, new building materials and machinery, structural and geotechnical engineering and disaster management. Apart from providing economic solutions to housing problems, the institute has been called upon on several occasions to provide expert advice on rehabilitation during calamities like earthquakes, cyclones and floods. Not only that, the institute has been called upon by several countries to render its expertise, which gives it an international stature.

CBRI celebrated its Fiftieth Foundation Day on 10 February 1997. This also marked the beginning of its year-long Golden Jubilee celebrations.

Inaugurating the celebrations, Dr R.A. Mashelkar, Director General, CSIR and Secretary, Department of Scientific & Industrial Research, Government of India, facilitated the institute on his own behalf and on behalf of the twenty-three thousand members of the CSIR family, and complimented it for its glorious achievements during the fifty years of its existence. In particular, he mentioned about the institute's recent contribution to the nation on rehabili-



Dr R.A. Mashelkar, Director General, CSIR, inaugurating the CBRI Golden Jublee celebrations



Dr R.A. Mashelkar releasing the Golden Jubilee Stamps to mark the beginning of year-long CBRI Golden Jubilee celebrations

tation programme for the Latur and Uttarkashi earthquake victims, landslides in Himalayas and cyclone in Andhra Pradesh. CBRI was on the forefront of all these societal programmes.

"While stepping in the twenty-first century," Dr Mashelkar said, "India will be facing challenging problems of housing as its population will swell to about 100 crore. CBRI has to play a very vital role in providing affordable solutions to this gigantic problem."

Dr Mashelkar also inaugurated the CBRI's 'Building Pest and Mycology Laboratory' on this occasion.

Prof. R.N. Iyengar, Director, CBRI, in his welcome address paid rich tributes to the founding fathers for their vision, and ex-scientists and employees for their contribution to raise this institute to its current glorious height. He also elaborated on the past and present achievements of CBRI. In particular he mentioned about the MoUs signed recently with Malaysia and Thailand to provide CBRI expertise and collaboration in different fields of building science and technology.

Shri V. Suresh, Chairman and Managing Director, HUDCO, New Delhi, who was Chief Guest on the occasion, delivered the Foundation Day address. Lauding the work of CBRI, in his address, he referred to under-reamed pile foundations in the coastal areas of Andhra Pradesh and Tamilnadu, which have withstood the vagaries of cyclones during the last three decades. The institute has made substantial contribution towards the development of several technologies for roofing, which have been utilized not only within the country but also in various other parts of the world. The recent UNCHS publication on the subject brings out the institute's contributions clearly.

The work of CBRI in the context of community asset building, like Navodaya Vidyalayas throughout the country has come in for special acclaim.

Shri Suresh emphasized the importance of development of building materials from industrial and other wastes so that the top soil of the earth and precious forests could be saved. He exhorted the media to popularize low-cost housing technology as they earlier popularized 'green revolution' among the masses.

To mark the occasion, Dr Mashelkar released the Golden Jubilee stamps of CBRI, which will be used in all correspondence this year. Prof. Iyengar released a set of new brochures highlighting the R&D activities in various disciplines of CBRI. Mementoes were presented by Prof. R.N. Iyengar to the CSIR Director General and Shri Suresh. On behalf of CBRI, Dr Mashelkar presented mementoes to Dr T.S.R. Prasada Rao, Dr R.K. Bhandari and Dr S.K. Misra, past Directors of the institute. Dr S.K. Misra introduced Shri V. Suresh. Smt. Mashelkar gave away prizes for the sports events held in the forenoon. Smt. Iyengar presented a memento to Smt. Mashelkar.

Dr N.S. Bhal, Dy. Director, conducted the proceedings of the day❑

REGIONAL RESEARCH LABORATORY, THIRUVANANTHAPURAM

R&D Highlights: 1995-96

WITH major contributions to technology development and transfer such as those related to processing of palm oil, coconut and synthetic rutile, high-level research output in well-cited journals and appreciable external cash inflow to augment the R&D funds, the Regional Research Laboratory (RRL), Thiruvananthapuram, continues to maintain high performance standards. Area-wise R&D highlights during 1995-96:

Palm Oil Programme

Teachnology upgradation of the Palm Oil Mill (POM) at Pedavegi was completed and the capacity of the mill augmented to 4 tonnes FFB/h. A matching Palm Oil Mill Effluent (POME) Plant with anaerobic and aerobic ponding systems was also commissioned. An additional grant of Rs 6.000 million was received from TMO&P for the technology upgradation programme.

Technology transfer related to palm oil processing received a major thrust with CSIR taking up the project coordination and the decision to make the palm oil technology a fully engineered package and its implementation through project engineering firms. Consequently, a techno-economic offer for a 10 tonnes FFB/h Palm Oil Mill on turn-key was made to A.P. Oil Federation for their future requirements with a total project cost of Rs 116 million. [MoU with A.P. Oil Federation signed recently; see *CSIR New,* 47 (1997), 18]. As part of the palm oil technology promotion in different regions of the country, three Palm Oil Mills of 2 tonnes FFB/h to be established in Goa, Gujarat and Tripura have been sanctioned by TMO&P. These are to be implemented during 1996-98 with a total outlay of Rs 33 million. Other technology transfer-related activities during the year were the signing of MoU with M/s Cauvery Sugars and Chemicals Ltd, for establishment of a 2.50 tonnes FFB/h Palm Oil Mill in Trichy District of Tamil Nadu, and selection of three project engineering firms for the implementation of the above cited projects under the supervision of RRL-T.

Performance Indicators: 1995-96

New Projects undertaken	: 19
Projects in hand	
(a) In-house	: 10
(b) Externally funded	: 40
Patents Filed	: 11
Publications	
(a) Foreign Journals	: 90
(b) Indian Journals	: 14
Proceedings	: 46
Books	: 2
Budget	: Rs 46.796 million
External Cash Flow	: Rs 19.760 million
Lab Reserve	: Rs 1.546 million
World Bank Loan	: Rs 5.000 million

The first phase of the programme on Vitamin A supplementation through Red Palm Oil among pre-school children, being pursued in collaboration with Vivekananda Kendra, has been completed. This study, involving 2700 Balwadi children, indicated the effectiveness of Red Palm Oil in terms of acceptability of the oil and improvement in the vitamin A and β-carotene status of the children. An intensive study (Phase II) was initiated to consolidate results from Phase I. A detailed chemical characterization of minor constituents from Red Palm Oil and Palm Oil Mill by-products is being carried out.

Another important basic work initiated during the year is estimation of oil content of Fresh Fruit Bunches (FFB) of oil palm under field conditions of Andhra Pradesh. Biochemical studies related to the purification and characterization of enzymes in the fruit, such as lipase, lipoxigenose, peroxidase, etc., that have bearing on the palm oil quality, are being carried out. Factors that determine the oil palm seed germination are being studied with a view to facilitating faster propagation of seedlings.

Coconut Programme

The technology for integrated processing of coconut was transferred to M/s Freshco, Irinjalakuda, for commercial production. As part of the engineering consultancy to the firm the laboratory has designed a plant to process 20,000 fresh nuts/day to produce coconut cream, cream powder, curry powder, shell charcoal, etc. with a total investment of Rs 22 million. All the equipment were fabricated as per the design under the supervision of RRL-T and installed in the plant. Integration of unit operations, trial production was taken up for final commissioning of the plant.

With a view to promoting home scale processing of coconut by women entrepreneurs, the technology developed for coconut cream has been modified and scaled down to the level of 50-100 fresh nuts/day. The unit operations have also been standardized for the purpose. It is proposed to train 10 to 20 women entrepreneurs per year under the programme.

Like other oil seeds processing, coconut milling is also done in the decentralized sector, using traditional technology. Process efficiency and product quality have not been given proper attention till now. It is proposed to review the techniques and methods adopted in coconut milling before taking up improved designs and processing. Work was initiated in this direction with financial support (Rs 3 million) from TMO&P. The project also aims at developing a process for extracting natural antioxidants from sesame seed/cake, which in turn could be used to improve the shelf life of edible oil.

Spices Programme and Flavour Technology

A Technology Development and Training Facility has been set up under a joint programme with the Government of Kerala, and installation of all equipment completed. Trial runs have been initiated.

The collaborative programme with Spices Board on finding substitute for sulphur dioxide in the manufacture of dehydrated green pepper was continued. Under an assignment from Spices Board, to find alternatives other than 4-hexyl resorcinol, good quality dehydrated green pepper was obtained by steeping fresh green pepper in citric acid solution at *p*H 5, before blanching and drying. Another programme with Spices Board on white pepper was continued for scale up of the bacterial consortium. Efforts are on to overcome the problem of contamination by fungi coming from black pepper.

A tolidine paper technique was developed for detecting chloropesticides at ppm levels. Spiked samples of pepper with chloropesticides were analyzed by this technique and found to be promising.

Under the programme to obtain flavour compounds of value, (+) limonene oxide was isomerized in presence of alumina pillared montmorillonite catalyst, and was found to give allyl alcohols as major products while acid-treated clay yielded carbonyl compounds.

Organic Synthesis

Studies concerning four major areas of organic synthesis were undertaken. (1) Carbon-carbon bond forming reactions mediated by cerium (IV) ammonium nitrate (CAN), (2) Cycloaddition reactions including higher order cycloadditions, (3) Auxiliary directed asymmetric synthesis, and (4) Organic reactions catalyzed by eco-friendly catalysts. The DST-sponsored project on 'Novel cycloadditions of *o*-quinones' has been completed and the final report prepared.

CAN-mediated oxidative addition of 1,3-dicarbonyl compounds to terminal alkenes has been achieved as a facile method for the synthesis of spiroannulated dihydrofurans. A novel reaction of benzylic radicals and dioxygen has been obtained in the CAN-mediated addition of dimethylmalonate to styrenes. A novel isomerization of tetramethylene fulvene to cyclopent-1-yliedene cyclopentadiene has been observed during the cycloaddition of *o*-quinones. The use of bile acids as novel auxiliaries for the chiral synthesis of γ- and δ-lactones and the synthesis of novel crown ethers derived from D-glucose have been studied.

Solid State Fermentation

The laboratory has been working on solid state fermentation (SSF) under a project financially supported by the Department of Biotechnology, New Delhi. The work includes studies of fundamental aspects of the process of SSF. A number of physical and chemical parameters like *p*H, temperature, moisture, and relative humidity, which are the crucial factors that affect the process, were studied using a fungal culture of *Aspergilus niger*. The suitability of natural substrates, available as agricultural by-products was exploited when it was found that in addition to wheat bran, other waste products like *copra* waste, have a good possibility of their use as substrate for enzyme production. An attempt was made to compare the role of iron and siderophore production by the fungal culture in liquid and solid cultures. The comparative studies on the production of glucoamylase enzyme in submerged and solid culture showed that the yields of the enzyme are many-fold more in SSF. Studies on the influence of water activity of the substrate showed that fungal growth and activity is highly dependent on a_w of the substrate. The other aspects of the study included the design of a bioreactor system for SSF processes. A bioreactor system was developed for the production of fungal spores.

Speciality Polymers

The activities in the area relate to study and development of polymers and composites having specific property profiles for high performance and functional applications. Following are the ongoing projects: (a) Melt processible liquid crystalline polymers (grant-in-aid project from DST, New Delhi, with industrial collaboration with IPCL, Vadodara), (b) In-plant study and technical advice for reduction of scrap in brake lining industries (consultancy project from M/s Sundaram Brake Linings, Chennai), (c) Development of transparent/clear resin from CNSL/cardanol (sponsored project from M/s Vijayalexmi Cashew Company, Quilon), and (d) Polymer composite technologies from natural fibres.

The causes for scrap reduction in a brake lining industry was identified and remedial measures suggested as part of the consultancy project. The feasibility of preparation of transparent/clear resin from cardanol was demonstrated. Optimization of the process for production of 8-(3-hydroxyphenyl) otanoic acid was carried out and the yield was raised to 60%. A few side chain liquid crystalline polymers containing azo mesogen were synthesized and characterized. The lyotropic behaviour of poly (esteramide) (PEA) polymer was studied in various solvents and it was observed that as the axial ratio of the polymer increases, the threshold concentration decreases [$\phi = 8/r(1-2r)$ where $r = l/d$]. The threshold concentration in *m*-cresol was found to be higher than that of NMP, which indicates that the polymer-solvent interaction parameter is higher for PEA-*m*-cresol system than that for the PEA-NMP system.

Discussions were held with various industrial firms for transfer of the technology for Polycoir. Samples of Polycoir products were prepared in bulk for market survey by M/s Coirfed, Kerala, who has initiated negotiations for acquiring the technology for commercial production.

Ilmenite Programme

The final phase of the transfer of process technology for the manufacture of high-grade synthetic rutile to the user industry, namely M/s Travancore Cochin Chemicals has been reached with the involvement of engineering consultants. The entire project is being implemented under the PATSER programme of the Department of Scientific and Industrial Research (DSIR) in association with M/s Travancore Cochin Chemicals (TCC).

The laboratory has successfully demonstrated the high product quality (95% TiO_2) consistently during several runs. The process parameters and the flow sheet have been optimised taking into account the requirements of product quality, cost and environmental constraints. By-product utilization is being explored with major emphasis to improve the economic viability of the process.

Process modelling and simulation studies were carried out to understand the important controlling steps in the rusting process in a stirred tank reactor as well as the metallization process in a rotary kiln.

Clays & Clay Minerals

Clay research, both basic and applied is being carried out mainly with external funding from government and private industries. During the last few years, five externally-funded projects have been completed.

In continuation of the activities on Zeolite 4A, a study of mixed zeolite as enhanced water softener as well as the use of zeolite X as precursor for preparation of cordierite ceramics is in progress. A new area, which has been started recently in value addition of clays, is the development of clay catalysts. Natural kaolinites from South Kerala were found to have excellent bleaching and catalytic activity. These clays on modification by thermal and acid activation were found to be excellent Friedel-Crafts alkylation catalysts. M/s Indian Oil Corporation, Faridabad, has sponsored the development of oligomerization catalysts from clays. This activity is in progress. Meanwhile, an international collaboration with STA, Japan, for 'Study on the preparation and evaluation of solid acid catalysts from clay materials' has been taken up for immediate implementation.

Structural Ceramics

Three major projects, one new and the others continuing, were pursued. Of these, the project on development of sol gel abrasives is funded by M/s Carborundum Universal Ltd. For the first time, fly ash tile compositions have been reduction fired to different colours in the range black to red. Three patents were filed in the area of sol-gel boehmite and alumina abrasives.

Electronic Ceramics

The major programmes in the area relate to high temperature superconductivity and development of new ceramic materials for electronic applications.

A new class of complex perovskite oxides $Ba_2 REZr_{6-x}$ (RE = Pr, Nd, Sm & Gd) & $REBa_2$, $Hf_{5.5}$ (RE= Y, Gd) have been synthesized and sintered as single phase materials with high sintered density and stability, by solid state reaction methods. These materials exhibited dielectric constants and loss factors which make these suitable for consideration as substrates for microwave application.

Thick films of $YBa_2Cu_3O_{7-\delta}$ fabricated on polycrystalline REBa2 $SnO_{5.5}$/ $REBa_2SbO_6$ substrates gave super conducting zero resistivity transition Tc(O) = 90°K, indicating the suitability of these materials as substrates for $YBa_2Cu_3O_{7-\delta}$ films.

A new group of compounds with composition $(Ba5\text{-}xSr_x)$ Nb_4O_{15} exhibiting high permeability and low-loss have been synthesized and characterized. Microwave dielectric properties of these compounds indicate their potential as ceramic dielectric resonators.

Alloys and Composites

The work on aluminium alloy matrix composites was initiated in the laboratory over a decade and half back. Realizing the immense potential of these composites in automotive and general engineering industries, an economically most viable and easily commerciable synthesizing route, i.e. stir casting, was developed. Over the years, the laboratory has acquired considerable expertise on synthesis and structure-property correlations of these composites with different aluminium alloy matrices of both cast and wrought type and dispersoids-like graphite, zircon and silicon carbide particulate (SiCp) and short carbon fibres using both liquid metal and nondendritic semi-solid slurry processing techniques. The laboratory has built one of the largest composite synthesizing facility (25kg/batch) in India. The process know-how on synthesis of graphite particle dispersed aluminium alloy matrix composites for self lubricated bodies has been handed over to NRDC for commercialization, whereas the process know-how for other systems is now getting ready for commercialization.

Efforts were made to identify the components and users for graphite dispersed aluminium alloy matrix composites. A few automotive components, like pistons, were identified and cast in a foundry in Agra, in collaboration with the Vehicle Research Development Establishment (VRDE), Ahmednagar. Feasibility of making low coefficient thermal expansion (CTE) composites with carbon fibre reinforcement is being looked into in collaboration with the Satellite Application Centre, Ahmedabad. Concerted efforts are also being made for developing net-shaped MMC components by resorting to semi-solid processing (SSP) techniques, in collaboration with a user automotive industry. The R&D programme on aluminium alloy matrix composites has received grant-in-aid support from AR&DB and DST, which is expected to continue in future also, along with additional support from other users like ISRO, VRDE and private industries.

The aluminium alloy development activity was initiated in the laboratory a decade back, through sponsorship from ISRO, on optimising heat treatment procedure for indigenous Al alloy equivalent to 7020 developed by them. Subsequently, feasibility of making thin wall premium quality sand castings for battery housing was taken up for ISRO, on collaborative basis. The success of this venture led to the award of sponsored work from LPSC-ISRO for the development of Al alloy equivalent to the French specification of AS7G and four types of premium quality sand castings, which was also completed successfully. Possibility of taking up some more projects on Al alloy development for cryogenic applications and their components is being considered. The R&D work on use of Rare Earths (RE) in Al alloys has shown improvements in their mechanical properties and modification of Si morphology. A project on development of RE- added Al alloys for electrical conductors is being sponsored by NALCO.

Computational Materials Science

The work in this area relates mainly to: Chaos in Fluid Dynamic Systems, Artificial Neural Networks and Understanding, Designing and Controlling of Materials Processing using computers.

A computer simulation model has been developed for visualizing the evolution of dendrite morphology in solidifying metals. Using this model as tool, numerical studies have been made on microstructural evolution in casting and effect of particles on the microstructures of metal matrix composites.

Wastewater Technology

The World Bank Project on 'Expansion of Industrial Wastewater

Engineering Laboratory' commenced in April 1994; the implementation period is 3 years and the operation period 10 years. This is the second year of implementation. More than 50% of the proposed equipment has been procured. A new engineering hall for housing the laboratory is under construction.

An effluent treatment plant for a milk chilling centre was commissioned at Pathanamthitta and trial runs were carried out. A contract project has been taken up from a private industry to provide technology for distillery effluents. Under this project, a modified UASB reactor of $1250m^3$ has been designed and being commissioned. Technical consultancy was also provided to M/s Kedia Distilleries Ltd, Bhilai.

Inorganic and Analytical Chemistry

The separation of individual lanthanides has assumed great interest because of their increasing demand in industry and their importance in high temperature superconductivity. Furthermore, the separation of lanthanides from each other and from actinides is desirable in the processing of nuclear waste materials. In continuation of its work on separation of these trivalent metal ions using mixed-ligand systems, the laboratory synthesized a highly acidic β-diketone, 3-phenyl-4-benzoyl-5- isoxazolone (*p*Ka=1.23) and utilized it for the extraction of lanthanides such as La, Eu and Lu and a trivalent actinide, Am, in the presence of various neutral oxo-donors. The addition of the neutral oxo-donor to the metal-chelate system not only enhanced the extractability of these metal ions but also increased the selectivity.

CFRI process for Pyridine-based Chemicals goes on stream

To reduce the burden of foreign exchange on the import of fine chemicals, the need for the indigenous production of high-priced, value-added commodity chemicals like pyridine and picolines and their subsequent conversion to fine chemicals and pharmaceuticals such as cyanopyridine, nicotinamide, has been felt since long. To this end the Central Fuel Research Institute, (CFRI), Dhanbad, has carried out systematic and extensive laboratory scale R&D work. The institute has developed the basic know-how and expertise for the production of pyridine-based chemicals and optimised the process parameters, thus inspiring the scale-up of the process so as to reap the benefits and to realize its commercial exploitation.

Having learnt about lab-scale success, the Dhampur Sugar Mills (DSM) evinced keen interest and, after seeing the step-by-step demonstration of the process and the effectiveness of the specialized catalyst in the laboratories of CFRI and having been convinced of its feasibility and viability, desired to commercialize the process. A memorandum of understanding was signed sometime back between CFRI and DSM for further scale-up and pilot plant study.

In pursuance of this, based on the laboratory scale data of CFRI, a pilot plant (50 kg/batch) was designed and fabricated with joint participation of Ideal Finechem (group of DSM), Lucknow and CFRI, and the maiden scale-up tests have shown amazing results -- the direct production of catalyst from 10 g/batch in the lab scale to 2.0 kg/batch in the pilot plant and that of the product (nicotinamide) from 10-15 g/batch in the lab scale to 15.0 kg/batch in the pilot plant could be achieved in the first trial commissioning test of the pilot plant itself, thereby establishing the direct translation of lab scale work into pilot scale.

As to the quality of the product, it was got independently analyzed by the party (Ideal Finechem) at Shriram Institute for Industrial Research, New Delhi, and the analysis results reaffirmed the success of the process. The purity of the nicotinamide has been found to be 99.5%, and it conforms to all the specifications of *Indian Pharmacopia* in respect of various important parameters including *inter alia* pH, heavy-metal nitro compounds, chloride, sulphate contents and melting range as also the loss on drying. The product nicotinamide is, in fact, at par with that of BDH (England) in all respects as evidenced by the FT-IR analysis.

The present production capacity of Ideal Finechem's Pilot Plant (50 kg/batch), is slated to be escalated to 250 kg/batch soon. ❑

The extraction of these metal ions in xylene with mixtures of 1-phenyl-4-benzoyl-pyrazolone-5 and dihexyl-N,N-diethyl carbamoyl methyl-phosphonate was also studied using tracer techniques.

In recent years increasing attention has been given to removal of heavy metals from wastewaters, not only from the point of view of pollution control but also to enable reuse of the water, and in some cases, to recover some of these heavy metals for potential use. In view of this, a programme has been initiated for the selective removal of heavy metals using solvent extraction as a tool.

Under another continuing programme on the development of novel analytical methodologies for determination of ultratrace amounts of heavy metals, a derivative spectrophotometric procedure has been developed.

Centre for Marine Analytical Reference and Standards (C-MARS)

Supported by the Department of Ocean Development (DOD), this Centre continued to provide services to the Coastal Ocean Monitoring and Prediction Systems (COMAPS) programme of DOD.

As a part of the activity, an International Conference on 'Environmental Science' with special emphasis on 'Present Status in the Analysis of Trace Metals and Nutrients in the Marine Environment', was organized at Thiruvananthapuram in the beginning of 1996.

Photochemistry Research

The research activities in the area pertain to: (i) photoinduced electron transfer processes in organic and semiconductor materials which have potential applications in solar energy conversion as well as study of such processes with a view to developing new synthetic methodologies in organic chemistry, (ii) polymer photochemistry such as photopolymerization, photodegredation and conducting polymers, (iii) organic phototransformations of multichromophonic systems, and (iv) use of sunlight/visible light for wastewater purification and sterilization.

Biomolecular Research

The research activities related to (i) study of self-assembling systems with particular emphasis on linear peptides, (ii) design and synthesis of novel cyclic peptides which can selectively transport alkali metal ions across biological membranes, (iii) preparation of multiple armed chiral, dendritic matrices crafted from amino acids to anchor peptide epitopes with the ultimate aim of designing peptide vaccines, (iv) DNA recognition study with minimal Zn-finger motifs, (v) study of protein folding mechanism through design of multiple cystine motifs, and (vi) protein/peptide engineering by chemo-selective modification. ❑

Technology Transfer

Cement Polymer Composite Coating

THE Central Electrochemical Research Institute (CECRI), Karaikudi, has developed technology for a new Cement Polymer Composite Coating System for use in reinforced steel structures.

Seen during the CECRI technology transfer (from left): Dr T. Ramasami, Director, CLRI; Dr N.S. Rengaswamy, Scientist, CECRI; Shri S. Sakthivel and Smt. Nadia Fakhruddin Ratlamwala (representatives of Mr Fakhruddin Ratlamwala); Prof. G.V. Subba Rao, Director, CECRI; Prof. R. Kumar, IISc and Chairman, TAB, Chemical Group, CSIR; and Shri B. Sathianandham, Scientist, CECRI

This technology is an improvement over the existing technology for anticorrosive treatment of steel reinforced rods, earlier developed by CECRI.

The above technology was released to Mr Fakhruddin Ratlamwala of Sharjah at a know-how fee of $ 40,000 on 2 December 1996. The technology document was handed over by Prof. G.V. Subba Rao, Director, CECRI, to Mrs Nadia Fakhruddin Ratlamwala and Mr S. Sakthivel, the representatives of the party, at a function organized for the release of a new brochure on 'CECRI Moving International' on 10 December at CECRI. Demonstration and training for the representatives of the party have also been completed during 2-12 December. ❑

DETAILS OF THE TECHNOLOGY

1.	Name	: [illegible]
2.	Application	: (i) [illegible] (ii) [illegible] (iii) [illegible] (iv) [illegible]
3.	Advantages	: (i) [illegible] and [illegible] (ii) Coating [illegible] (iii) Coating [illegible] and [illegible] prestressing steels (iv) As per ASTM Standards has good corrosion resistance and chemical resistance (v) Has good weathering resistance (vi) As per ASTM Standards has good abrasion resistance.
4.	CECRI Process	: The coating system consists of a primer and a sealing coat (i) An improved formulation for a rapid setting primer useful for corrosion protection of reinforcing and prestressing steel. Indian Patent No.481/DEL/93 dated 13.05.93 (ii) An improved coating composition for corrosion protection of reinforcing steel and prestressing steel. Indian Patent No.259/DEL/92 dated 25.03.92
5.	Present demand	: Out of about 2 million tonnes per year of steel reinforcements being produced in this country, at least 0.5 million tonnes per year may need this coating
6.	Scale of investigation	: Shop-coating level
7.	Cost Estimate Capacity	: 6,000 tonnes per year
	(i) Land and Building	: Rs 5 million
	(ii) Plant and Machinery	: Rs 15 million
	(iii) Working capital	: 3.2925 million
	(iv) Cost of production	: Rs 13.160 million
	(v) Sales	: Rs 27.7 million
	(vi) Return on Investment	: 48%
8.	Terms and conditions	: Lumpsum premium : $ 40,000 Recurring Royalty : 2.5% Nature of licence : Non-exclusive Period of licence : 7 years.

For further details please contact: The Director, Central Electrochemical Research Institute, Karaikudi 630 006 (Tamil Nadu)

High yielding guggul cultivar released

GUGGUL (*Commiphora wightii*) is cultivated for the oleogum resin which has wide applications in allopathic, ayurvedic and unani systems of medicine. E and Z guggul sterones are the major compounds of interest from this plant as they produce the drug for etheroscelrosis. Recently, the drug has achieved prominence due to its anti-inflammatory, anti-rheumatic, hypocholesteremic, hypolipidemic and anti-fertility activities. Its extract also reduces serum cholesterol and effects catecholamine metabolism considerably. A cholesterol lowering drug from the guggul has been already released by the Central Drug Research Institute, Lucknow, and is in the market.

India used to produce over 40 tonnes of guggul gum from arid tracts of Rajasthan and Gujarat states. But, indiscriminate and faulty method of collection of guggul gum by making deep incision at the plant base and resultant destruction of plants has pushed guggul plant to category 'A' of endangered species. Now a mere 4-5 tonnes of guggul gum is being traded in the Rajasthan and Gujarat markets and is registering a downwards trend. Some improvement, however, took place with the extraction technique using

Guggul *(Commiphora wightii)* plant var. *Marusudha* in the field in winter season (*Top*) and summer season (*Bottom*)

ethephon at the rate of 400 ml per tree, thrice in a year. But the trees could not be saved after the harvest. Other methods developed so far relate to getting more guggul gum, but not much attention has been paid to save the plant. Further, no improvement programme for guggul gum plant has been taken up to identify a superior clone having higher guggul sterones from the genetic resources of guggul plant available in Rajasthan and Gujarat.

To fill this gap, the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, took up the studies, and has developed a high yielding strain of *C. wightii*, and standardized a method of extraction of guggul, based on crop growth. The new method of extraction assumes great significance as it not only saves the plant from drying (or dying) but also makes it possible to harvest high concentrations of E and Z guggul sterones over a period of several years starting from the second year of planting. An integrated agro-technology of guggul with various medicinal and aromatic crops under irrigated and rainfed conditions has shown that it is possible to get a net return of up to Rs 38,000 in second year, Rs 44,000 in third year, Rs 48,000 in fourth year and Rs 71,000 in fifth year per hectare, depending upon the intercrops.

The high yielding *C. wightii* accession, now named as cultivar *Marusudha*, possess significantly higher percentage of guggul lipid. The planting material of cultivar *Marusudha* is available at CIMAP for commercial cultivation. ❑

Introduction of Low-tech Agrotechnologies for Rural Uplift in Trans-Himalaya

THE Regional Research Laboratory (RRL), Jammu, is actively involved in various R&D activities for economic development of cold desert region of Ladakh. In this region, the potential of traditional land-based activities has reached its limits and there is a growing need to modernize and modify the existing traditional cropping system to make it more remunerative. In view of this, a concept of application of low-tech agrotechnologies has been envisaged by the laboratory, which involves introduction of high-value exotic crops for taking the economic benefits to the rural poor.

Drastic climatic conditions, inaccessibility and very short growing seasons (June-September) are limiting factors for growth of agro-based industry in this region. Keeping in view the overall condition of this region, a biovillage approach is being adopted, with active participation of the Ladakh Autonomous Hill Development Council, for integrating with equity the principals of ecological sustainability and economic profitability to make the present research programme pro-nature and pro-poor.

Artemisia annua in glass house at Stakna, and *Salvia sclarea* in flowering under open conditions in Nimu, Ladakh

Eco-adaptation of some selected exotic aromatic plants (particularly annuals and biennials) is being studied for the first time in this cold arid desert. The scientists of RRL-Jammu have accepted the challange to make the desert green and at the same time attractive for the aromatic industry to start a base in this part of the country. The experiments on culturing of important essential oil-bearing plants like *Artemisia annua* (annual), *Artemisia pallens* (annual) and *Salvia sclarea* (biennial) were started in October 1995 under poly-house/glasshouse conditions. The activity was shifted to field in May 1996. The laboratory has been successful in introducing these exotics in Ladakh. Initial studies have shown that the oil yield and quality are up to the mark. ☐

CSIR participates in AGRO TECH'96 at Chandigarh

CSIR participated in the AGROTECH '96 held at Chandigarh during 27 November-1 December 1996, by displaying technologies of four of its institutes: Central Food Technological Research Institute (CFTRI), Mysore; Central Scientific Instruments Organisation (CSIO), Chandigarh; Central Electronics Engineering Research Instiute (CEERI), Pilani; and National Chemical Laboratory (NCL), Pune. The exhibits that created tremendous interest among the viewers include: agro-electronics & process control systems from CSIO and CEERI; *dal* mill, *papad*-making machine and paper-making machine from CFTRI; and the tissue culture technique from NCL. Several farmers from Punjab, Haryana, Rajasthan, Karnataka, Tamilnadu and Pondicherry have expressed desire to set up tissue culture lab in their farms, especially for sugarcane and cut flowers, with the NCL know-how and consultancy.

The CSIR stall was housed in the international hall where countries such as Israel, Holland & Australia had also put up their stalls. CFTRI exhibits were also put up in the ministries of Food and Agriculture's stall. ☐

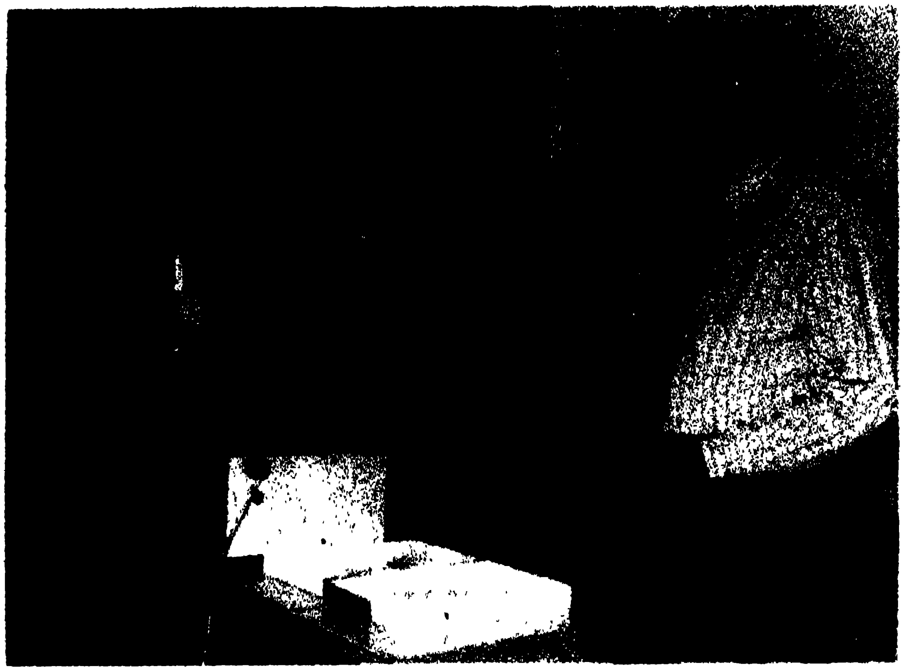
CSIR stall at AGRO TECH'96

S&T Scenario in Germany

DR R. Balasubramaniam had given lectures on numerous occasions on vibration, structural dynamics, aeroelasticity, etc. when he was a scientist in the National Aerospace Laboratories (NAL), Bangalore's Structures Division. But on 16 January 1997 he spoke on 'S&T Scenario in Germany' in his capacity as Counsellor (S&T) at the Indian Embassy in Bonn, Germany, to a packed audience at the NAL's TS Seminar Hall.

In his lecture, which went on for about 45 minutes, Dr Balasubramaniam presented a splendid overview of the S&T scenario in Germany. "German S&T is changing, the new orientation is towards more international collaborations together with a marked 'opening up' of German academic establishments to international students", he said.

Discussing the status of R&D funding in Germany, Dr Balasubramaniam pointed out that one sees "much the same trend everywhere: federal and state governments funding is falling; but in Germany, at least this is compensated by a significant upward trend in industry and private non-profit funding". Indeed, Dr Balasubramaniam's detailed account of the role played by private non-profit agencies such as Helmholtz, Max Planck, Fraunhofer, etc. in R&D funding ("they support up to 90% of the R&D effort") proved to be a real eye-opener.



Dr R. Balasubramaniam, Science Counsellor at the Indian Embassy in Gennany speaking on the 'S&T Scenario in Germany'

If Dr Balasubramaniam's structured account of the German S&T scenario was valuable (a few copies of his presentation material are available for distribution with Shri M.R. Narasimha Swamy, Head, Technical Secretariat, NAL), the numerous information titbits which accompanied the lecture were equally valuable: the fact that DLR and DARA (the German aeronautical and space agencies respectively) are going to merge ("primarily to reduce manpower"); the proposed German thrust in preventive research (which will be a major cornerstone of future R&D strategy"); the great Chinese influx in German S&T in the 1990's, statistics about the DAAD scholarships over the years ("the perception that there are national quotas in the awards of DAAD fellowships is wrong—it is truly open and international selection"); the success of the "two plus two" model for international R&D collaboration (industry + R&D lab. of foreign country with a German industry + R&D lab.); the dearth of good research scholars in German universities (like in many other countries, including India!); and the innovative idea of a 'Blue List Institute' to cover R&D support for areas not supported by established non-profit organizations.

Dr Balasubramaniam was welcomed by Dr B.R. Somashekar (who had himself completed a very successful innings as S&T Counsellor in Bonn during 1988-91) and with an audience which included the DRDL team led by its Director Lt. Gen. Dr V.J. Sundaram which was spending the day at NAL to discuss joint NAL-DRDL collaborative projects. ❑

Labour Secretary visits CMRI

DR Lakshmidhar Mishra, IAS, Secretary, Ministry of Labour, Government of India, visited the Central Mining Research Institute (CMRI), Dhanbad, on 7 January 1997.

Prof. Bharat B. Dhar, Director, CMRI, briefed Dr Mishra about the R&D activities and achievements of CMRI, and took him to various laboratories, particularly those related to testing of mining equipment.

At the end of his visit, Dr Mishra expressed that CMRI had rendered remarkable services to the Directorate General of Mines Safety (DGMS), an important organization under the Ministry of Labour, particularly with regard to testing of various mining equipment procured by different mine authorities. The relevant test results and certificates supplied by the institute have helped DGMS to approve these equipment for use in mines. He said, "CMRI over the years has built up a good reservoir of scientists and technologists who are instrumental in undertaking these tests. These tests are of great relevance to the development of mining industry, particularly to the area of mine safety". "A visit to this premier scientific and technological research institute is not only educative but also stimulating". He stressed for greater interaction between CMRI and DGMS. This would be of immense help in the larger interest of protecting the lives and limbs of innocent miners while giving boost to the production and productivity in the mining industry. He expressed his confidence that CMRI would prosper further under the dynamic leadership of its present Director Prof. Dhar. ❑

TRAINING PROGRAMMES

Entrepreneurship Training Programmes on *Chulhas*

THE Central Fuel Research Institute, Dhanbad, has developed two models of improved domestic *chulhas* namely *Angarmitra* and *Angarbandhu*, having power rating 1.4 and 1.0 kW respectively. These two models have been approved by the Ministry of Non-conventional Energy Sources, Government of India; under Category V for propagation. The thermal efficiencies of these *chulhas* range around 40% as compared to 25% of the conventional *chulhas* available in the market. The pollution level of these *chulhas* is considerably low as compared to conventional *chulhas*.

Participants observing performance of *Angarbandhu* and *Angarmitra* during Entrepreneurship Training Programme on Improved *Chulhas* at CFRI.

With this background, an entrepreneurship training programme under the National Programme on Improved *Chulhas* of the Ministry of Non-conventional Energy sources was organized at the Central Fuel Research Institute, from 9 to 18 December 1996.

The programme was aimed at imparting theoretical and practical training for development of entrepreneurship for manufacture of improved *chulhas* (portable metallic domestic *chulhas*) based on soft coke/briquettes.

The training programme was attended by 15 participants from different regions of Bihar.

The concluding programme was also attended by the Branch Managers of the local branches of SBI & BOI. At the end of the training programme, certificates were given away by Shri P.K. Bandopadhaya, Senior Deputy Director, CFRI.

CFRI will arrange similar type of training programme for two more batches during the next three months. ❑

CRRI Library dedicated to Prof. S.R. Mehra

THE Central Road Research Institute (CRRI), New Delhi, dedicated its library to Prof. S.R. Mehra, its first Indian Director who served the institute from 1955 to 1968, at a function held on 20 December 1996. Dr R.A. Mashelkar, Director General, CSIR, was the Chief Guest. The function was attended by a large number of highway engineers, researchers, administrators and library and S&T information professionals.

Dr S.M. Sarin, Chairman, Library Committee and Co-ordinating Scientist, Environment and Road Traffic Safety Division of CRRI, in his welcome address spoke about the dynamism and thrust provided by Prof. Mehra to the institute in its formative year.

Dr A.K. Gupta, Director, CRRI, described Prof. Mehra a man of vision who valued information as one of the most important resources for research and provided all facilities for the healthy development of the library and its resources. Dr Gupta highlighted the achievements of the CRRI library such as it becoming World Interchange Network (WIN) Node and its modernization and access to international databases on CD-ROM. He assured, "We will improve the CRRI Library and Information System in line with *CSIR Vision 2001*, and make this library one of the best in the field of roads and road transport".

Prof. P.B. Mangla, Department of Library and Information Science, University of Delhi, in his address mentioned that Prof. Mehra was a dedicated scientist and scholar, and made concerted efforts towards shaping the CRRI Library. Having a rich collection of about 90,000 publications access to worldwide information this library can be considered as one of the best in India in the area of Road Research. He stated that the library professionals should effectively play the role of information professionals in today's information world.

Smt. Shanta Mehra, wife of late Prof. S.R. Mehra, in her address mentioned that CRRI had a special place in Prof. Mehra's heart, who was very much concerned about the need for research in soil stabilization and low-cost road construction. He always took joy in institute's progress and would have been proud of its achievements. She expressed her appreciation for the gesture shown by associating Prof. S.R. Mehra's name with the institute's library.

Shri M.C. Ragavan, former Head, Documentation and Library Services, CRRI, who developed and nurtured this library with his sincere efforts and hard work, had sent his reminiscenes from Cambodia where he has gone on a UNESCO assignment. Recalling his memories, Shri Ragavan wrote: "Prof. Mehra had deep interest in the growth and development of CRRI Library since the first day of his assuming the office of Director, and provided all support and encouragement to build the library a centre of excellence in this part of the world in the field of highway engineering".

Dr R.A. Mashelkar in his inaugural address mentioned that CRRI is very fortunate to have had Prof. S.R. Mehra, leader and visionary as its first Indian Director. He not only created basic infrastructure but also succeded in developing the library as well. Dedicating a library like this to the memorary of a visionary like Prof. Mehra is a real tribute that an institute can pay to a great leader. He expressed that the libraries not only generate information but provide a conducive environment in which information can be converted into usable knowledge which embodies wealth creating potential. He formally declared CRRI library as 'Prof. S.R. Mehra Libarary'. He also released a brochure 'CRRI-A Profile' on this occasion.

Shri S.P. Gupta, Head, Documentation and Library Services, proposed a vote of thanks. ❑

Smt Shanta Mehra addressing the gathering at the function for dedicating the CRRI Library to Prof. S. R. Mehra

ISMMACS—A New Society for Mathematical Modelling and Computer Simulation

A new society, the Indian Society for Mathematical Modelling and Computer Simulation (ISMMACS), has been formed on 17 December 1996. The aims and objectives of ISMMACS are:

- To promote the application of MMACS in all branches of knowledge;
- To organize conferences, symposia, seminars and training programmes in MMACS;
- To publish books, monographs, bulletins and conference proceedings on MMACS;
- To collaborate with institutions, industries and professional bodies engaged in MMACS both at national and international levels;
- To institute awards and prizes for outstanding contributions to MMACS; and
- To take necessary steps for the development of teaching and research in MMACS and nurture its applications in all branches of knowledge.
- ISMMACS would presently be located at IIT, Kanpur. The society's Executive Committee will have Prof. Roddam Narasimha, ex-Director, National Aerospace Laboratories (NAL), Bangalore, as its President and Prof. Kirit Parikh and Prof. Vinod Gaur as its Vice-Presidents, and a number of distinguished modellers, drawn from diverse fields and diverse parts of India, as members.

The first meeting of ISMMACS, was held at NAL on 17-18 December 1996. Prof. J.B. Shukla, ISMMACS's General Secretary, spoke about the aims and objectives of the Society in the course of the inaugural function. It was followed by a remarkable lecture by Prof. U.R. Rao on his experiences with MMACS. The former ISRO Chairman was at his best as he described what went wrong with the first PSLV and voiced his concern at the growing problem of space debris ("travelling at speeds of 10 km/s, the debris would crush a space vehicle like a speeding truck on a highway would impact an unfortunate human being"). No lecture by Prof. Rao these days is complete without some plain talking and this lecture proved to be no exception ("I am not at all excited by this monsoon prediction business—indeed, I find that the more we study monsoons, the less we seem to know about them"; or "our agricultural modelling is terrible!").

Prof. Narasimha, who spoke next, explained why he believed ISMMACS's time had come: "As we specialize in narrower and narrower fields, contact between scientists diminishes. I believe that only mathematical modelling can provide the unifying force; indeed, the best route to approach scientific truth might soon become the 'mathematical' rather than the 'mechanical' model" the ISMMACS President noted.

Prof. Kirit Parikh, the distinguished economist, then went on to deliver his keynote lecture on 'Models in poilicy analysis'. It was a rare privilege to hear Prof. Parikh, especially because one doesn't often get to hear great lectures on non-aerospace subjects in NAL's Systems Auditorium (the last such lecture one easily recalls was by Prof. Padmanaban on bio-medical applications). To illustrate the point that modelling is required not just in "Prof. U.R. Rao's exotic world of outer space but also in the mundane world of Shri H.D. Deve Gowda:", Prof. Parikh disucssed two questions requiring policy analysis: "Should we remove the fertilizer subsidy?" and "How should we negotiate with Enron?". It was an illuminating exposition in which Prof. Parikh talked of economic variables, models and compulsions, with a finesse which only comes to a true master. Dr R.N. Singh and his colleagues at C-MMACS, made about 20 presentations bringing forth the overwhelming feeling that MMACS is the wave of the future—and that ISMMACS could well go on to become one of the harbingers of this approaching wave. ❑

Dr P.K. Seth appointed Director, ITRC

DR P.K. Seth, Scientist 'F', Coordinator, Predictive Toxicology Group and Head, Developmental Toxicology and Neurotoxicology Sections at the Industrial Toxicology Research Centre (ITRC), Lucknow, took over as Director of the institute on 31 January 1997, from Dr R.C. Srimal who attained superannuation. He is the fifth Director of the institute which was founded on 4 November 1965.

Dr Seth (born on 15 June 1943) obtained his Ph.D. (Chemistry) from the University of Lucknow, Lucknow, in 1967. He then proceeded to USA for advanced training at Chicago Medical School, Chicago, USA, as Faculty Research Associate and soon became Assistant Professor and stayed there up to 1971. His sincere desire to serve his country brought him back, and he joined ITRC in 1971 as Scientist C.

Dr Seth has actively pursued both basic and applied research over the past 29 years and played a major role in the growth of modern toxicology, particularly neurotoxicology, in the country. His main interest in the basic research has been to delineate the role of neurotransmitter receptors in the action of the chemicals acting on the central nervous system. Using appropriate ligands, characteristics of the serotonergic (5HT1 & 5HT2) and

dopaminergic (D1 & D2) receptors in human platelets have been demonstrated. The clinical significance of blood platelet receptors was shown by his studies where assay of dopamine receptors in Parkinson's patients helped identify two subpopulations - one exhibiting increased 3H spiroperidol binding and responsive to L-DOPA, and other exhibiting reduced binding and unresponsive to L-DOPA.

He has significantly contributed towards the standardization and establishment of suitable testing protocols and guidelines for the safety evaluation of plastics and polymers in the country. An institutional facility for the safety evaluation of plastics for packaging, storage and delivery of food, drugs and cosmetics was also established. The findings on the toxicogenic potential of phthalate esters, monomers and other additives have helped the Bureau of Indian Standards and Central Committee for Food Standards, Ministry of Health, Government of India, to specify the requirements of the testing of plastic materials to be used in the country.

Dr Seth has actively contributed to the Technology and Societal missions and has served as the Coordinator for the Rajiv Gandhi National Drinking Water Mission at ITRC.

The contributions of Dr Seth are well recognized by the peers. He is recepient of Board of Trustees Research Award of the Chicago Medical School, Chicago, USA; Scheweppe Foundation Award, USA; Jordi-Folchie Pi Award of ISN and C.R. Krishna Murthy Memorial Lecture Award of Society of Biological Chemists (India). He has been conferred fellowships of the National Academy of Sciences, India, and Academy of Environmental Biology. He is a founder fellow of Society of Toxicology (India) and Indian Academy of Neurosciences, and is currently serving as the Acting President of the latter. In addition to various national scientific bodies, he is a member of several international scientific bodies such as International Brain Research Organisation, International Society of Neurochemistry, Sigma XI, American Society of Neurochemistry. In recognition of his contributions towards biochemical pharmacology & toxicology he has been elected as the Councillor for Section of Toxicology and Councillor of Drug Metabolism of the International Union of Pharmacology (IUPHAR).

Dr Seth has been a Visiting Senior WHO Fellow to UK and Europe. On invitation, he served as Visiting Scientist at the National Institute of Environmental Health Sciences, NIH, US Food and Drug Administration and University of Texas Medical Branch, Galveston, USA. He has also been a Visiting Professor at University of Grand Forks, North Dakota and Louisiana State University Medical Centre, New Orleans, USA. He is a widely travelled scientist and, on invitation, has visited several countries including USA, UK, China, Australia, Sri Lanka, Italy and delivered invited lectures.

He has 194 publications in peer-reviewed journals to his credit and has contributed several invited review articles and book chapters. He also has edited three books, and is currently serving on the editorial board of several national and international journals. He has three patents and two technologies to his credit. ❑

Honours & Awards

Dr M.K. Gurjar selected FAO/WHO Consultant

DR M.K. Gurjar, Deputy Director & Head, Organic Chemistry III Division, Indian Institute of Chemical Technology (IICT), Hyderabad, has been selected as an expert consultant to attend the Joint Food and Agriculture Organisation/World Health Organisation Consultation on Carbohydrate in Human Nutrition at Rome, Italy, on 14-18 April 1997. Dr Gurjar has received this recognition for his outstanding contributions to the field of Carbohydrate Chemistry for the last 15 years. He is also a recipient of several major awards including the CSIR Young Scientist Award, CSIR Technology Award and the Ranbaxy Award. ❑

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at NISCOM Printing Unit
Annual Subscription : Rs. 60
[illegible] Editorial Assistant : Neelima Handoo Production : Kaushal Kishore Single Copy : Rs. 3.00
[illegible] Fax : 5787062

ISSN 0409-7467

VOL 47 NO 5 15 MARCH 1997

CSIR NEWS

INSDOC develops improved system for preparing electoral I-cards

THE preparation of electoral I-cards for voters in Delhi was started with the videography of the President of India, Shri Shanker Dayal Sharma on 1 November 1996. As of April 1996, there were around 8.06 million registered voters in 70 assembly constituencies comprising about 9000 polling stations in Delhi. In the first phase (1994-95), five contractors, including the Indian National Scientific Documentation Centre (INSDOC), New Delhi, were engaged to carry out the monumental task of making I-cards for the voters in Delhi [*CSIR News*, 46 (1996), 68]. These contractors prepared and distributed 5.23 million I-cards. The remaining about 2.8 million I-cards are being prepared and distributed in the second phase. Two contractors have been engaged — INSDOC is covering 50 assembly constituencies and M/s Metro Infrotech, the remaining 20 constituencies.

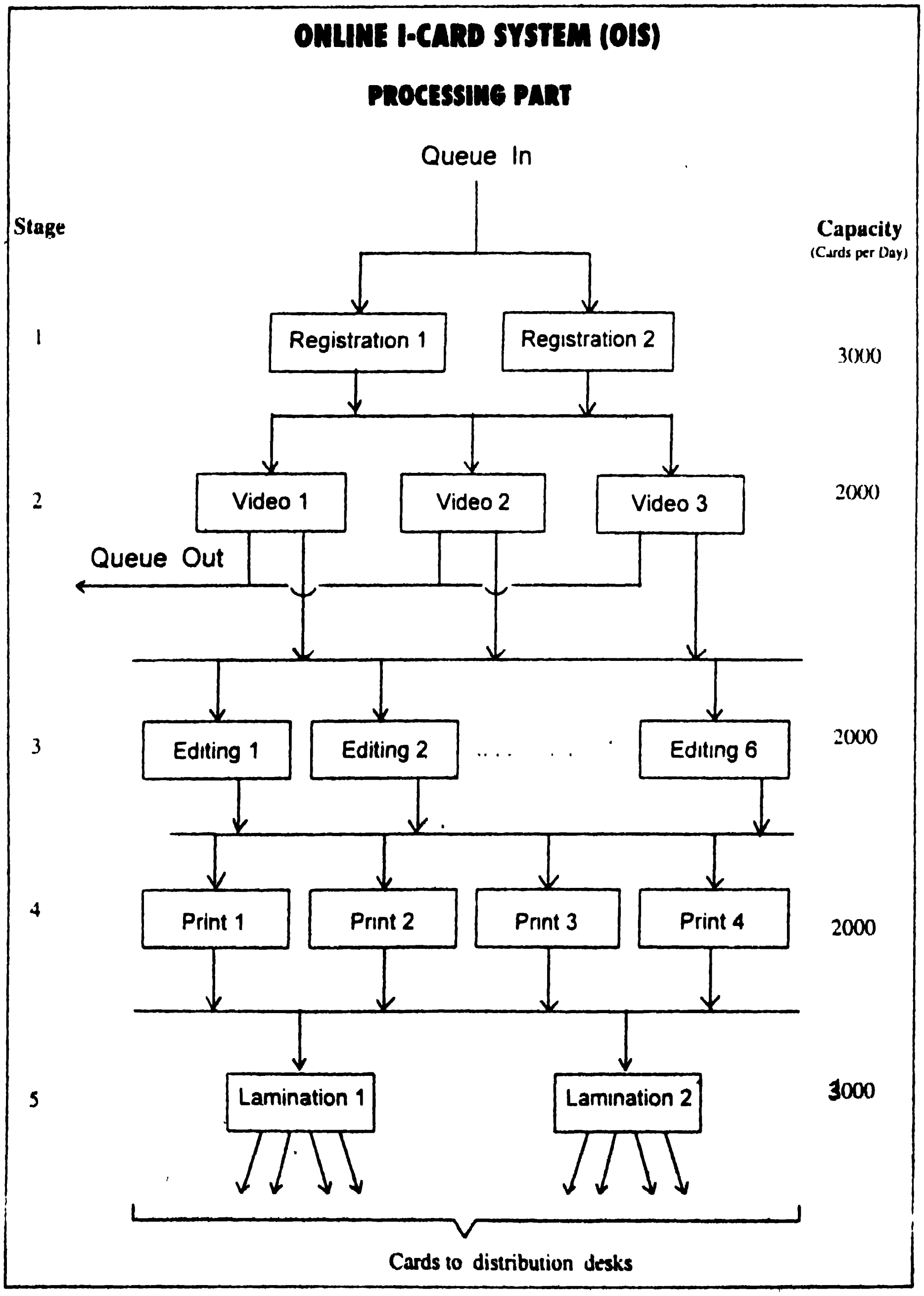
In the first phase, the task of preparing the I-cards was carried out constituency-wise and within a given constituency, the data were processed polling station-wise. The entire system and software were designed around this model, which is generally called the 'off-line' system. In this system, a number of centres were set up at different polling stations where voters were videographed either through a video camera or a camera attached to a computer. Thereafter, the images were brought to a central place and processed by merging the electoral data with the image. Typically, there was a gap of 3-6 months between the process of videography and delivery of cards. And then there were a number of errors in the cards prepared. About 5% of the cards were returned by electorates for corrections.

In the second phase, where the remaining 2.8 million voters are spread all over Delhi, a system based on polling station/assembly constituency-wise processing would not have been efficient. Therefore, the concept of permanent centres has been introduced, wherein more than one assembly constituency can be handled at any time. Electors can visit these permanent centres on any day as per the announced campaign, get them videographed and collect the card the same day.

The Improved System

INSDOC, the first such permanent centre, has redesigned the electoral I-card processing system, making it capable of handling multi-constituency data simultaneously. In this system, the electoral data are edited/corrected 'on-line', and the cards are produced immediately thereafter. The time gap between videography and the production of the card may be as low as 15 minutes or as high as 4 hours, depending on the rush of voters. The system has been designed to minimize the waiting time of the voters in the queue, and delivering the cards on the same day.

Manual system of enumeration and processing of electoral data is prone to errors at different stages. Firstly, the base entry by the enumerator can have errors. Secondly, the error may get introduced at the computer data entry stage. In the absence of reliable computerized transliteration, errors can creep in at the time of keying in data in Hindi. Also, at the time of videography, voters are identified by a set of numbers and errors can occur in assigning and representing such numbers. When a group or a family of voters come together for videography, there is chance of identification slips (which contain only numbers) getting mixed up. For example, wife may be holding husband's slip and the husband that of the wife. This leads to the classifical widely reported mistake of cards being produced with wife's picture and husband's data and vice versa. Finally, all through different stages of computer processing, voters are identified by numbers which are entered manually. This can also lead to errors in production.



In order to minimize errors in the present system, the voter is required to fill in a form giving his exact name and address, which is used for on-line correction of the electoral data after due authentication by the electoral staff. Check points have also been introduced in the software to minimize different types of errors that creep into the system. As a result, the error rate is less than 0.7%, i.e. less than 7 cards per 1000 persons videographed. Most of the errors relate to voters desiring to express their names in English and Hindi in a manner that does not fit into standard transliteration process or to cases where titles such as Shri and Shrimathi are part of the actual name.

For the convenience of the voter, the card distribution system has also been simplified by putting a counterfoil on the form, on production of which the card can be collected. It is not necessary for the voter to be personally present for collecting the card and one may just send the counterfoil duly signed through a messenger for getting the card.

For efficient data storage and processing, a number of innovative ideas have been introduced by INSDOC. In the earlier method of data management, each assembly constituency data pertaining to about 100,000 voters used to take about 100M byte of disk storage. In the new system which extensively uses the concept of 'data dictionary', each constituency data occupy on an average only 10 MBytes, an improvement in storage efficiency by a factor of 10! This is achieved by introducing the 'name dictionary', 'address dictionary', 'house number dictionary' and 'initials dictionary' in the data organization. An efficient scheme has also been evolved for handling multi-part names of the users, which imposes no restriction on the number of initials or the number of parts a voter may have in his/her name.

The present on-line system is designed around what is known as 'pipeline architecture' in computer parlance. This is similar to a production or assembly line in a factory. An important step in designing such a system is to ensure that the different stages in the pipeline are properly balanced. The system has five stages of operation in the pipeline, (see Figure).

The system design is fully modular and the capacity of the system can be scaled up or down easily, by adding or removing computing resources. A pipeline stage may contain more than one computer in order to ensure that stage timings are balanced. At the present level of operation, INSDOC is using about 12-14 computers giving a production rate of about 150 cards per computer per day. INSDOC is targetting to achieve a higher production rate per computer in the near future so that the investment in the capital equipment may be reduced and the system made more cost effective. This can lead to a larger number of permanent centres being opened all over the city of Delhi, thereby increasing the public convenience and at the same time keeping the cost factor low. The emphasis on the present design has been on robustness of the system and hence INSDOC has decided not to use a fully 'LAN-based' design which may be prone to full-scale virus attack and large-scale corruption of data. In future, however, a safe LAN-based version may also be developed.

The improved system was explained by the INSDOC Director Prof. T. Viswanathan and the Chief Election Officer Shri T.T. Joseph to the media persons at a press conference cum demonstration held on 1 March 1997. Over forty persons representing the print and electronic media attended the conference and greatly appreciated the INSDOC's efforts towards making the I-card preparation process efficient and at the same time cost effective. ❑

Shri T.T. Joseph, Chief Election Officer, addressing the press conference on Preparation of Electoral I-Cards at INSDOC. At this conference INSDOC Director Prof. T. Viswanathan (second from left) explained to the media persons his institute's efforts towards making the I-Cards preparation process more efficient and cost-effective. Others seen in the photo (from left) are: Shri R.N. Mangla, Dy. Chief Election Officer; Dr Prema Parvatharajan, Project Leader; Shri O.N. Chaddha, Project Incharge; and Shri B.R. Sharma, Dy. Project Leader

CRRI to help solve Delhi Traffic Problems

ENORMOUS increase in vehicular traffic has made Delhi as one of the most polluted and accident-prone city in the country. With a view to solving the traffic and pollution problems, Lt. Governor of Delhi, Shri Tajendra Khanna has constituted a Traffic Management Task Force (TMTF) in February 1997. TMTF comprises Central Road Research Institute (CRRI), School of Planning and Architecture, Confederation of Indian Industries, Institute of Road Traffic Education, Transport Department, Delhi Development Authority, Municipal Corporation and several NGOs. This inter-agency group will consider measures for untangling the traffic problems, including revival of the 'cycle track scheme' and act as coordinator between the various civic agencies and the Traffic Department to improve traffic management in the capital.

ITRC IOC MoU for Studies on Toxicological Profiles of Petroleum Products

THE Industrial Toxicology Research Centre (ITRC), Lucknow, and Indian Oil Corporation Limited (IOC, R&D Centre), Faridabad, Haryana, have signed a Memorandum of Understanding (MoU) for studies on Toxicological Profiles of Petroleum Products/Chemicals. The MoU was signed by Dr R.C. Srimal, the then Director of ITRC, and Dr A.K. Bhatnagar, Executive Director (R&D), IOC, on 29 January 1997 at Faridabad.

According to this MoU, ITRC will undertake studies which would involve acute/subacute toxicological effects of petroleum products from IOC and would provide toxicologic profiles for preparation of material safety data sheets and for safer product development. Also, joint efforts will be made for the human resource development in the area of Health and Environmental Risk Assessment by organizing lectures and workshops. The two institutions will be able to enlarge their capabilities and activities by sharing the existing resources and expertise. ❑

Dr R.C. Srimal and Dr A.K. Bhatnagar exchanging the MoU documents

As a member of this task force, CRRI has suggested several measures to help ease the traffic movement in areas having bottlenecks. The task force has identified seven high congestion points as well as 200 other points where congestion is reaching alarming proportions.

At its first meeting, held recently, the members of the task force discussed the improvement of road engineering, side lanes, traffic islands and pavements. It was decided to have standard roadsigns, and to issue fitness certificates to the vehicles only after stringent tests. ❑

Isolation process for a hepatoprotective drug developed

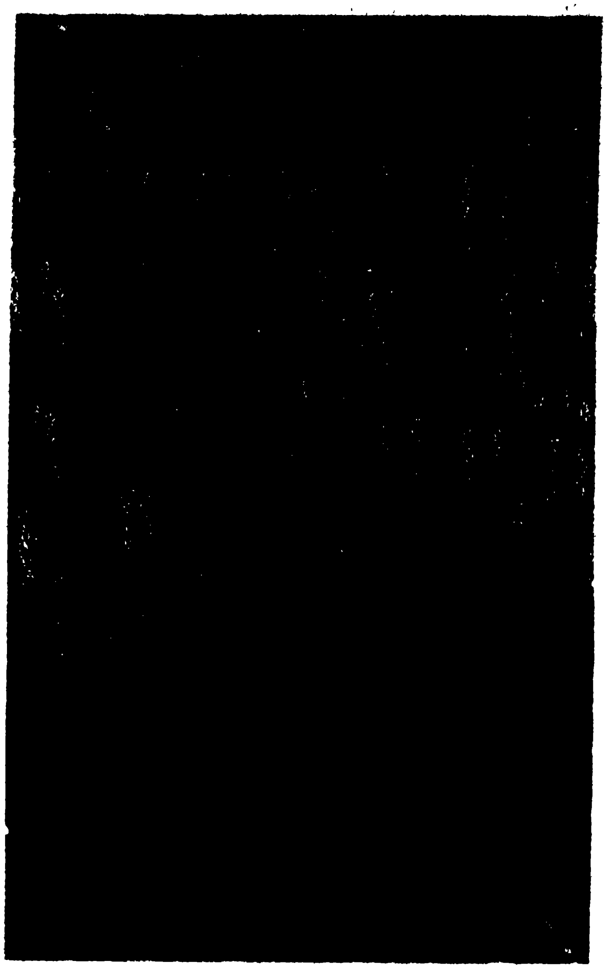
HEPATIC disorders are a major concern of medicinal plant research now-a-days as the synthetic drugs have not been significantly effective in liver injuries. It is known that the natural products are quite effective in the recovery of the liver damage. The Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, has developed a process for extraction of a phytochemical from *Lantana camara,* a weed which is abundantly available throughout the country and contains a high concentration of the phytochemical. This phytochemical has been patented in Japan as an additive to the health drinks and hair tonics. In skin cancer therapy, it has shown low side effects. The compound also possesses antiinflammatory, antihyperlipidemic, antiulcer, hypoglycaemic and anticarcinogenic activities. The toxicity tests on the phytochemical have shown that it is a relatively safer drug for hepatic disorders.

CIMAP has filed a patent for the process. Pharmaceutical houses are invited to make use of the material in production of a life saving drug. ❑

High-yielding Psyllium genotypes

PSYLLIUM (*Plantago ovata*) is cultivated for its husk and seeds. India is a major exporter of isabgol, the seeds of Psyllium. In fact, it enjoys monopoly in its production and trade. Yet the production level falls much below the global demand, and there is a lot of scope for extending its cultivation from Gujarat and adjoining Rajasthan tracts to other drier parts of north and south Indian states. This could be achieved by evolving genetically manipulated varieties suitable for agro-climatic conditions of these regions.

The Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, as a part of its germplasm enhancement activities, initiated an irradiation programme on *P. ovata*. Twenty-six promising mutants were isolated and evaluated leading to the selection of six most promising strains. Of these, two mutants, M 20-22 and M 30-2-3 have now been isolated on the basis of final pilot scale trials. ❑



A promising clone of Psyllium (*Plantago ovata*) in the pilot scale trial

Energy Management Instrumentation at CSIO

TIFAC-CSIO Board on Instrumentation had commissioned sometime back a study on Energy Management Instrumentation to M/s Symatec Associates Pvt. Ltd, Bombay. The firm conducted the study and submitted its report. This report covered the overview of energy management in India, instrumentation range for energy management, main technology management trends, present status in India, R&D activities, user needs and approach to technology development.

Subsequently, the Central Scientific Instruments Organisation (CSIO), Chandigarh, organized a Workshop on 'Emerging Scenario in Energy Management Instrumentation--Directions for Future' at Chennai. This workshop attracted delegates from institutes like Energy Management Centre - New Delhi, Central Power Research Institute, Tata Energy Research Institute, Indian Institute of Technology - Chennai; Anna University, CSIR, etc.; manufacturers of energy mangement instruments like M/s Enercon Systems Pvt. Ltd, M/s Alacrity Electronics Ltd, M/s India Meters Ltd; as also delegates from public and private sectors like M/s W. S. Industries, M/s Pace Automation Ltd, M/s M. K. Raju Associates, M/s Symatec Associates Pvt. Ltd, etc. The topics discussed include: Energy Audit Instruments, Instruments & Systems in Power Generation & Distribution; Instruments & Systems for Energy Management in Industries, Calibration of Energy Management Instrumentation, Government Controls & Incentives, Need and Role of Facilitators, etc.

Studies on energy conservation in various segments of Indian industry have shown that there is a potential to reduce 10-30% energy consumption in industries through proper assessment, monitoring and audit. Sophisticated electronic, electrical and mechanical instruments are required for this purpose. CSIO plans to enter into this area in a big way, to capture the potential for resource generation.

A Memorandum of Understanding (MoU) between Energy Management Centre (EMC), Ministry of Power, Government of India and CSIO was signed by Dr Bhaskar Natarajan, Director, EMC and Dr K.R. Sarma, Director, CSIO, to work jointly in the areas of energy audit, design and development of energy management instrumentation; for providing calibration and service facilities across the country; for energy management instruments and training of users as well as entrepreneurs development for energy management services.

This activity has so far attracted a funding of Rs 2.75 million from external sources and Rs 1.0 million from internal resources. Additional funding is also envisaged in the form of providing equipment for calibrating energy management instruments.

The CSIO's Service & Maintenance Centre at Chennai has designed and developed a Solid State Single-Phase Energy Meter and Three-Phase Real and Reactive Energy Meter Circuits. M/s India Meters Ltd, Chennai, sponsored the development of these equipment. The products are under pilot production.

An On-line Analyzer for Energy Monitoring and Conservation has been designed and developed for industries. This is a Personal Computer/ Microcomputer-based Electronic Networking System for providing Energy Management Information suitable for all type of industries. Alongwith various type of periodic reports, the system provides critical energy parameters like Specific Energy Consumption (SEC) and Energy Cost Factor (ECF). The system has been extensively tried at M/s India Meters Ltd. CSIO collaborated with M/s Pace Automation Ltd, for the development of the analyzer. The Department of Science and Technology (DST) sponsored this project.

Monitoring and Target Setting (M&TS) systems have been extensively in operation in advanced countries like UK. The Energy Management Centre, New Delhi, had sponsored a project at CSIO for the development of software package for the Monitoring and Target Setting System for process industry. For the implementation of the project, CSIO has conducted an elaborate Energy Audit alongwith the Confederation of Indian Industries (CII), Chennai, in a petrochemical industry. This audit has evolved the specifications for the hardware and software of the system and brought out the energy saving potential in the industry by using the M&TS system.

CSIO has taken up an in-house laboratory project on the design and development of Electric Power Analyzer. This is based around the Digital Signal Processor Technology. The project is expected to provide spin-offs for the development of instruments needed for Demand Side Management.

CSIO has perfected the technology for microcomputer-based portable data loggers for monitoring and logging energy audit environmental parameters like relative humidity, temperature, light intensity, air velocity, pressure, flow, etc. Identification of suitable sensors is in the process.

Energy Management Instruments Calibration

CSIO has facilities for calibrating process measuring instruments like temperature, pressure, speed, light intensity, RH, weight, length, voltage, current, frequency, time, etc. Additional equipment is required for calibrating combustion analyzer, thermocouples, RTDs, power analyzers, etc.

Energy Management Centre (EMC) has launched the India-European Community (EC) Energy Management Cooperation Programme-Phase II. Under this programme, EMC is in the process of identifying the lead agencies to support the Energy Management Instrumentation Calibration activity with the European Community aid.

CSIO has studied the requirements of EMC and submitted a proposal for Instrument Calibration under the above programme, with a budget estimate of Rs 3.0 million. Shri B.B.Tunnah, Consultant, India-EC Project, visited the CSIO's Chennai laboratory during January 1996 and was satisfied to recognize it as the lead agency for support. He recommended a set of instruments to be supplied to CSIO.

Creation of Energy Audit Cell

Keeping in view the vast business potential, CSIO had earmarked a budget of Rs 1.0 million for the creation of Energy Audit Cell at CSIO, Chennai. EMC had provided an additional grant of Rs 1,25,000 for the creation of facilities. CSIO has already procured portable audit instruments like electrical power analyzer, combustion analyzer, non-contact low temperature measuring thermometer, lux meter, RH meter, tachometer, hand-held *p*H meter, and conductivity meter. Procurement of instruments like steam trap tester, portable power analyzer, environmental parameter data logger, non-contact high temperature thermometer, portable differential thermometer with various sensor configurations and harmonic analyzer is in the pipeline.

Working contacts have been established with Confederation of Indian Industries, Petroleum Conservation Research Association, National Productivity Council, Tata Energy Research Institute, etc.

Creation of other infrastructure for literature collection, knowledge

& skill upgradation, identification of a business consultant for initial help is in progress.

Training Programme

CSIO organized a training programme on 'Instrumentation and Control Systems for Controlling Energy Costs' last year at Chennai, under the India-European Union Energy Management Cooperation Programme. Two experts from Europe acted as faculty alongwith other specialists. The course identified and discussed many control problems which have bearing on energy conservation in cement, paper, petrochemical, engineering, textile, metallurgy and food industries. Twenty persons comprising scientists, engineers, managers, attended the programme. Six companies demonstrated their products. ❑

Processes Licensed/Demonstrated and Sponsored/Consultancy Projects taken up by CECRI

THE Central Electrochemical Research Institute (CECRI), Karaikudi, has licensed the following processes: (i) Yellow chromating formulation for aluminium and (ii) Low-temperature zinc phosphating [M/s Sakthi Enterprises, Hyderabad; Lumpsum premium (LP) Rs 25,000, Recurring Royalty (RR) 2.5%, Period of Licence (PL) 7 yrs; and LP Rs 25,000, PL 10 yrs, respectively]; (iii) Rust converter and (iv) Rust preventing composition [Polychem Industries, Rohtak; LP Rs 30,000, PL 10 yrs and LP Rs 50,000, PL 10 yrs respectively]. The above processes have also been demonstrated to the respective parties.

The sponsored projects taken up include: (i) Cadmium plating of maraging steel components (Aeronautical Development Agency, Bangalore; Rs 10,00,000); (ii) Design, study and construction of micro power sources and their use in micro electronic and communication technology (Ecole National Superiure dechime et de physique de Bordeaux, France; Rs 30,40,000);

(iii) Development and fabrication of electrode boiler (Indian Veterinary Research Institute, Bangalore; Rs 4,80,000); (iv) Development of image plate using photostimulable phosphor for application in computer radiographic imaging system (Department of Atomic Energy, Mumbai; Rs 25,38,060).

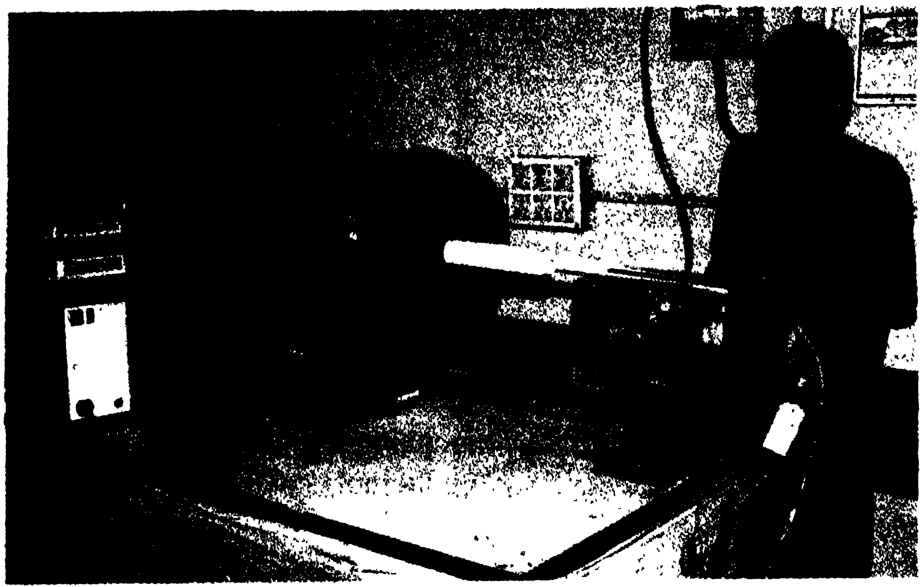
The consultancy projects undertaken by the institute in the recent past were: (i) Training programme on lead acid stationary batteries and automotive batteries manufacturing—care and maintenance (Indian Small Scale Storage Battery Components Manufacturers Association, Calcutta: Rs 56,000); and (ii) Advice on painting proposed to be carried out in Jawaharlal Nehru Port Trust, New Bombay (Jawaharlal Nehru Port Trust, New Bombay; Rs 1,05,000).

The institute offered technical services for (i) Testing of 2V/40 Ah stationary batteries (Mysore Thermo-electric Pvt. Ltd, Bangalore; Rs 55,000); and (ii) Development of vapour phase corrosion inhibitor for ferrous and non-ferrous metals (Alagappa University, Karaikudi; Rs 50,000). ❑

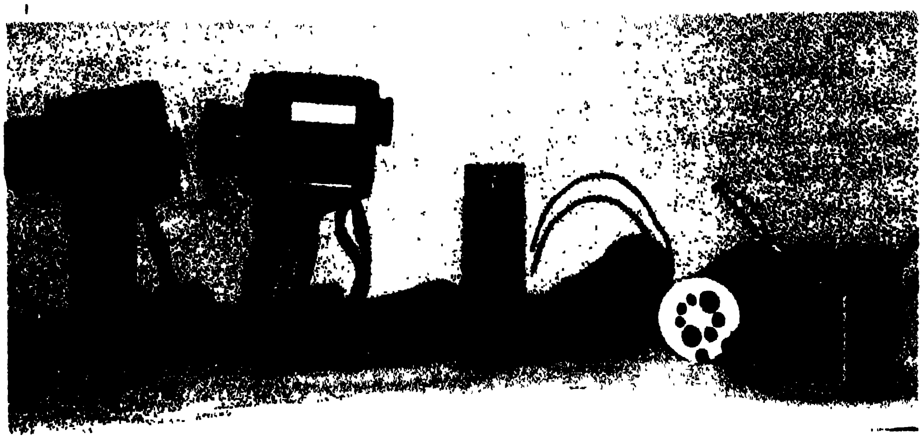
Calibration technique for total radiation pyrometers, thermocouples and other industrial sensors

THE calibration of thermocouples and radiation thermometers as per International Temperature Scale of 1990 (ITS-90) in the temperature range of ambient to 1600°C, constitutes a single most important activity of any metrology/calibration laboratory. Calibration service of this nature is vital for a variety of industries where precision requirement is not as high as for a research laboratory. Calibration at fixed points of ITS-90 is not only expensive but proves to be tedious for a good realization. Comparison calibration against calibrated thermometer, on the other hand, offers an alternative technique which is not only affordable but also yields precision data in a relatively short time.

Dr Mansha Ram, under the guidance of Dr R.G. Sharma of the National Physical Laboratory (NPL), New Delhi, has devised a comparison calibration technique for total radiation pyrometers, thermocouples and other industrial sensors, from ambient to 1600°C. In this, the intercomparison of thermocouples types B/R/S and the radiation thermometers is carried out against a standard in a uniform temperature enclosure (metallic/ceramic dry blocks) kept in temperature-controlled blackbody furnaces. These thermocouples and radiation thermometers are then used for comparison calibration of the similar type of thermometers by putting the test thermometer in close proximity with



Set-up for calibration of TCs and IR thermometers in dry block of ceramic kept in a horizontal temperature -controlled blackbody furnace



IR thermometers and uniform temperature enclosures (graphite blackbodies and metallic dry blocks)

the corresponding calibrated thermometer. For most purposes, ease of use and reproducibility of calibration sources are of prime importance as compared to an absolute measurement. This dry block comparison calibration technique, extendable up to a temperature of 1600°C, is an efficient means of calibrating the industrial sensors on ITS-90 scale within tolerable uncertainty. The stability of temperature inside the comparison block of ceramic is within ±0.3°C over 5 cm zone used for these calibrations.

This facility provides a practical method for calibration of temperature measuring instruments including industrial sensors. ❑

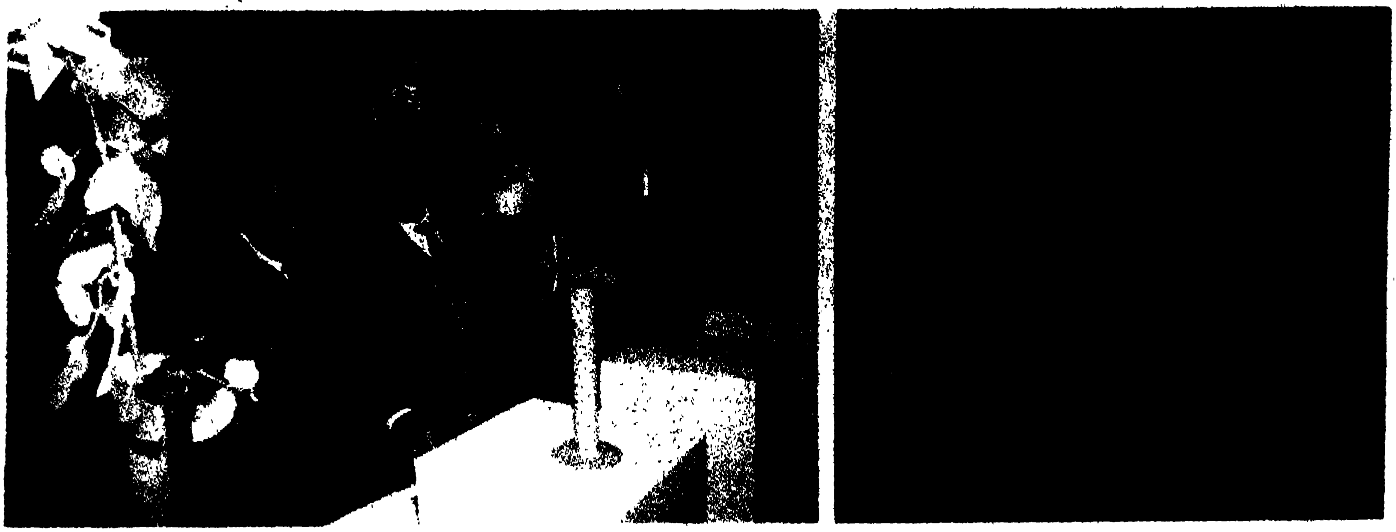
Rose and Gladiolus Show at NBRI

THE National Botanical Research Institute (NBRI), Lucknow, organized the Annual Rose and Gladiolus Show on 18-19 January 1997 at its Central Lawn. Clusters of cut flower pots, showing the entire spectrum of splendid flowers vying with each other for their intrinsic beauty. A large crowd flocked to see these prized specimens, scattering splash of colours mingled with the inimitable fragrance of roses. The show attracted this year a total number of 929 entries from 105 competitors from Lucknow and outstation.

A feast of colours the flower arrangements had a fantasy of romantic and highly literary names, imaginative, literary and appealing themes, like 'Heaven's delight', 'Love at first sight', 'Basant samete bahon mein,' 'Be violet and not violent', 'Unity in diversity', 'Strive for the best', 'We have many thorns yet we live in peace', 'Friendship', 'Hum aap ke hai kaun', 'Widows of Kashmir', etc.

The Hindustan Aeronautics Ltd, Lucknow Division, stole the show by lifting as many as nine running challenge cups/shields/trophies. HAL, Lucknow was followed by Shri S.P. Sharma, General Manager, HAL, Korwa, Sultanpur and HAL, Korwa, each lifting two running shields/challenge cups. Other competitors who won one trophy/shield/cup each in different categories are: Km. Sudarsh Kaur, Principal, City Montesseori High School, Rajendra Nagar, Lucknow; Adhishasi Abhiyanta, Matatila Bandh Prakhand, Jhansi; Director, CIMAP, Lucknow; Shri Anoop Kumar, Hotel Clarks Avadh, Lucknow; A.D.G. Police, Intelligence Deptt., U.P. Lucknow; Km. Poonam Singh, Lucknow; Smt. Rani Upsam, Hotel Clarks Avadh, Lucknow and Geeta Garden Decorator and Gladiolus Grower, Lucknow.

This year, the prizes for best red rose of the show 'Christian Dior' and best Indian bred H.T. rose of the



NBRI Rose and Gladiolus Show 97: Dr R.C. Srimal, the then Director of ITRC and others admiring the prize-winning entries at the show; and a prize-winning rose

show 'Mrinalini' were given to HAL, Lucknow. Prizes for best H.T. stripped/streaked rose of the show 'Careless Love' and best yellow rose of the show 'Golden Giant' were won by Karamchari Sangh, HAL, Korwa; best H.T. bicoloured rose of the show, by Adhishasi Abhiyanta, Matatila Bandh Prakhand, Jhansi; best fragrant rose of the show by Nuesrey, HAL, Korwa; and best spike of the Gladious of the exhibition by Km. Poonam Singh, Lucknow.

NBRI displayed in a separate section its choicest collection of exotic and Indian bred roses, besides a large number of mutants evolved such as, 'Tangerine Contempo, 'Sharda', 'Yellow Contempo', 'Sukumari', 'Twinkle' and 'Light Pink Prize'. Additional attraction of the flower show was the display plot of the choicest gladiolus cultivars near the venue of the exhibition.

An eye-catching section of the show was that of gladioli where a large number of colourful varieties were on display. Most of the 30 gladiolus cultivars evolved suitable for cultivation in Gangetic Plains were on display. The entries were adjudged by a panel of 30 distinguished judges, drawn from the various parts of the country.

Dr B.P. Singh, Senior Scientist, NBRI, welcomed the Chief Guest Dr R.C. Srimal, the then Director, ITRC, Lucknow. Dr Srimal in his address appreciated the efforts of NBRI in developing new varieties of rose and gladiolus and their release for the nursery trade. He also gave away the prizes to the successful competitors. ❑

Edible Natural Colouring Materials

THE demand for natural gum and dyes obtained from plant sources is increasing worldwide because of their safe use as food and beverage colorants and food supplements. The Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, is pursuing research activities on the extraction and isolation of such products from common food plants for quite some time. The institute has developed and standardized economically viable bench scale procedures to extract colouring materials from six such plants. These plants are: *Carthamus tinctorius* (Safflower); *Butea monosperma* (Palas or Tesu); *Tagetes erecta* (Marigold); *Beta vulgaris* (Chukandar); *Daucus carota* (Black carrot); *Capsicum annuum* (Chilli). ❑

Six-petalled Mutant in Periwinkle

A pink flowered periwinkle *(Catharanthus roseus)* mutant with distinct morphological markers has been identified at the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow. This mutant plant has erect leaves, twisted corolla and six petals in contrast to the normal five petals. The mutant was cloned through stem cuttings as well as micro propagation technique and has been crossed to the original inbred parent used as control and to the white petal cultivar 'Nirmal'. Since a significantly higher level of the ac-

Periwinkle (*Catharanthus roseus*). (left) Plant with conventional five petalled flowers; (middle) Pink and white flowers with six petals; and (right) Plant showing six petalled flowers

tive constituent vincristine was detected in the leaves of this six-petalled plant, the mechanism of inheritance of this trait and its possible linkage with gene(s) governing the expression at the secondary metabolite level was studied. The F_2 generation has shown both white and pink flowered plants with six petals which are being assessed for the level of their alkaloid content. This will help breeders in quick identification of the plants possessing higher level of secondary metabolite in the marker assisted selection programmes. ❑

SEMINARS

Mine and Industrial Fire

THE Central Mining Research Institute (CMRI), Dhanbad, organized a Seminar on Prevention and Control of Mine Fire — Trends and Challenges (MIF'96) at Indian Institute of Chemical Biology (IICB), Calcutta, during 21-22 December 1996.

Inaugurating the seminar, Shri U. Kumar, CMD, South Eastern Coalfields Limited, said, that prevention and control of mine fire are essential to save the national loss as a result of burning of a huge amount of coal owing to mine fire." Lauding the R&D contributions of CMRI in the field of mine fire, he urged the mining industry to make use of the latest technologies for prevention and combat of mine fire.

The Chairman of Organizing Committee of the seminar and Director, CMRI, Prof. Bharat B. Dhar highlighted the R&D work done by CMRI in the field of mine fire.

Shri S. Bagchi, an eminent mining engineer and former Director of the then CMRS, narrated his wide experience which later provided food for thought for discussion in the technical sessions.

Dr T. N. Singh, Deputy Director, CMRI, outlined the aims and objective of the seminar.

Shri A.K. Acharya, Convener of the seminar and Scientist, CMRI, proposed a vote of thanks.

The inaugural session was followed by technical sessions which were attended by about 100 delegates from 30 different organizations. A recommendation committee was formed, which was headed by Shri P.L. Munshi, GM (Environment), BCCL, and had as its members Dr A.K. Gupta, Scientist, CBRI; Shri K.M. Bakshi, GM (Rescue), CCL; Shri S. Nagachari, SME (Rescue Services), WCL; Dr R.V.K. Singh, Scientist, CMRI and Dr D.D. Tripathi, Scientist, CMRI.

Shri A.K. Sahay, Director (T) CIL, delivered the valedictory address. Shri P.L. Munshi presented the recommendations formulated by the committee, based on the deliberations in the technical sessions:

RECOMMENDATIONS

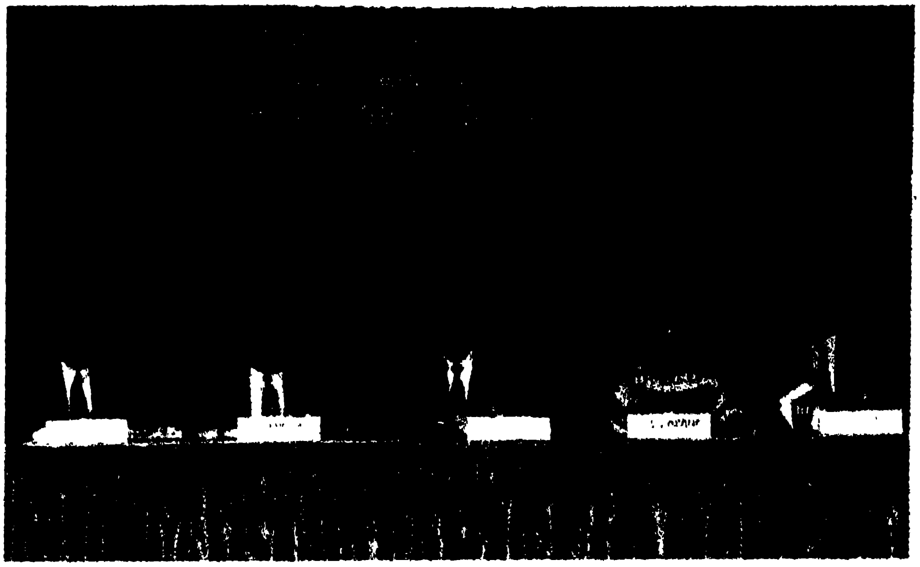
Safety and Preventive Measures

The ventilation pressure plays a major role in spread of fire in underground mines. Therefore, pressure survey should be regularly carried out, particularly in those mines which are liable to spontaneous heating or where fire exists. And based on these, corrective measures should be followed for the particular mine.

Also, thermo-compositional monitoring should be carried out periodically in the vulnerable areas of underground mines.

Equipment

Sufficient quantity of fire fighting equipment (portable and others) is available in the market and should be kept ready for emergency use.



Prof. B.B. Dhar, Director, CMRI, speaking at the inaugural session of the Seminar on 'Prevention and Control of Mine and Industrial Fires — Trends and Challenges'. Others sitting on the dais (from left) are: Dr T.N. Singh, Shri U. Kumar, Shri S. Bagchi and Shri A.K. Acharya

Periodic testing of all types of safety equipment stocked in the store should be carried out, taking into account their shelf-life. This could be done by batch testing of 10% of the equipment on regular basis.

Sufficient fund should be made available to meet the emergency demands, and the procedure for transfer of this fund to the manager/agent level should be simplified.

Laboratory testing facilities with proper and latest insturments should be provided as per the needs and requirements of the mines. This is particularly important in case of gassy/fire-affected mines.

New Techniques

A number of techniques/items have been developed which are available to deal with the fire problems. These are sealants (fire protective coatings), high expansion foam, grouting materials, high temperature resisting plastering materials, pyrometer, CCTV cameras, and modelling techniques namely 'CALFIRES', etc. Industry should take advantage of these methods and items to prevent/combat mine fire.

Research and Development

R&D should be continued both at research organizations level and mine level, for developing economically viable methods for combating and prevention of fire.

Collaborative work on R&D by coal and non-coal organizations should be accorded due importance. The results of such collaborative work should be disseminated from time to time by organizing workshops, training programmes, seminars, symposia, etc.

A Core Committee drawn from users and research organizations should be constituted for periodic review of status and progress of R&D work in the area. CIL Safety Board could initiate such an action.

Six-monthly survey should be carried out by research organizations to assess the coal loss owing to fire.

Norms for safe storage of coal should be followed strictly to avoid incidences of fire in coal stacks.

Efficacy of rescue equipment and ancillaries must be periodically checked by research and similar organizations.

Training

A dedicated and a responsible organization should be established for dealing with all aspects of mine fire.

Suitable and competent persons should be inducted in rescue stations and the fire dealing personnel should be properly trained in all aspects of fire problems.

It is of utmost importance that the user industry should introduce a quality check for all safety items used in mines, including props, shoes, self-rescues, etc. The Committee recommended that 5 - 10% of each safety items purchased by coal companies should be tested as per standard specification on regular basis. This should be made mandatory, if safety has to be taken seriously in the interest of overall benefit of the industry. ❑

TRAINING PROGRAMMES

Manufacture of Glazed Wall Tiles in Small-scale Sector

AS a part of its Human Resource Development Programme for Ceramic Industry, with special emphasis on small-scale sector, the Central Glass & Ceramic Research Institute (CGCRI), Calcutta's Naroda Centre has been conducting since 1993 a series of Training-cum-Demonstration Programmes on non-traditional technologies for diversification. CGCRI has already organized four such short-term training programmes of 10 days' duration each, focusing on various technologies and testing of raw materials & finished products in 1996. The fifth programme was conducted on 'Production of Glazed Wall Tiles in the Small-scale Sector' from 26 November to 5 December 1996.

The programme comprised theoretical lectures and practical demonstrations covering the following aspects: recent advancements in the production of ceramic tiles; basic raw materials and their characteristics; preparation of tile bodies and making of tiles; wall tiles frits and glazes; kiln furniture for wall tile production; firing of ceramic tiles and ceramic kilns; decoration of wall tiles; testing and control; and defects in wall tiles production and their remedies. Seventeen participants—six from Morbi; five from Himmatnagar; three from Ahmedabad, and one each from Rajkot in Gujarat State, Bankura in West Bengal and Indore in Madhya Pradesh participated.

A panel discussion was arranged on 'Modernization of Glazed Wall Tile Industry in the Small-scale Sector in Gujarat' on 3 December. It was chaired by Shri R.J. Shah, Chief Industrial Adviser, Government of Gujarat. S/Shri B.N. Das, Hon. Secretary, Indian Ceramic Society, Gujarat Chapter; K.V.K. Raju, Dy. Director (Glass & Ceramics), SISI, Ahmedabad; V.G. Malkan, Consultant GMDC, Ahmedabad; J.V. Bhatt, Sr. Dev. Officer, INDEXTb, Ahmedabad; S.C. Chopra, Sr. Vice President, Madhusudan Ceramics; and A.G. Sahijwani, Manager, SIDBI, Ahmedabad, participated in the discussion as experts. Dr K.N. Maiti, Head, Traditional Ceramics & Rural Pottery Division of CGCRI, Scientist-in-Charge of CGCRI Naroda Centre and Chairman, Indian Ceramic Society, Gujarat Chapter introduced the subject and gave a brief account of the global scenario in ceramic tiles and the related technological practices vis-a-vis the Indian scenario.

Out of 177 SSI glazed tile units in India, 145 units are located in Gujarat State. The largest concentration of 38 units in Morbi out of 52 in the Rajkot district, is followed by 22 units each, in Mehsana & Surendranagar districts, 7 in Ahmedabad, 5 in Baroda and 37 in other places throughout Gujarat. The present annual production of all these units taken together is about 225,000 MT which is about 30% of the total production of ceramic tiles in India. The demand of ceramic tiles in India by 2000 A.D. would be about 1.3 million MT, of which the units in Gujarat are expected to produce about 350,000 MT. On the Global Scenario, India occupies eighteenth position in production and seventeenth in consumption having produced 35 million square metres of tiles in 1995.

However, the technology being practised by the SSI units in Gujarat and elsewhere is quite outdated and way behind the technologies being practised at the international level. Stressing on the need of improvement in productivity and quality in the era of liberalization, Dr Maiti initiated the panel discussion on the major issues of modernization; raw materials; machinery & equipment; process technology; energy; demand potential and marketing; as well as finance. Other issues like manpower & human resource development, recycling & utilization of solid waste, waste heat utilization as well as government interventions for restructuring sales tax and excise tariff, etc. were also touched upon. All participants undergoing the T&D programme also actively participated in the discussion.

The unanimous views on various modernization aspects of glazed tiles units, for production of ceramic tiles of international quality with total rejections to the tune of about 5%, are:

Raw Materials & Machinery

On the raw materials issue, the units should resort to quality checking of raw materials and other inputs, which would help them ensure consistency in the quality of raw materials. One important raw material, namely wollastonite, which is currently in short supply and has become a monopoly item, may be gradually replaced by alternative raw materials like pyrophyllite, sericites, synthetic wollastonite, etc. in the tile body composition. Regarding the modernization of machinery and process technology, although it was agreed that the introduction of spray drier, roller hearth kiln, hydraulic press of higher capacity are desirable, the main impediment is the investment limit of Rs 6 million in the SSI units, as all the equipment are cost intensive and need to be imported. However, it was felt that the units may immediately switch over to atleast 100 MT press instead of 40 MT, which is currently in practice. This will help in reducing the rejections of tile industry significantly. The waste heat of tunnel and shuttle kilns might be utilized for drying of tiles. The panel suggested that the existing glazing system of water fall method be continued for some more time while the improved and the latest glazing and decoration techniques might be introduced in the second phase of modernization.

Energy Consumption

On the energy front, the concensus view was that the supply of gas & electricity is far from satisfactory, although the ceramic units are classified as continuous process industries. Shri J.V. Bhatt pointed out that the State Government is proposing new coal-based thermal power stations along the coastal belt, which would use imported coal and help alleviate this problem. The experts emphasized that the consumption of energy may be reduced by efficient use and by conducting energy audits with the help of National Productivity Council.

Demand Potential and Marketing

The panel deliberated that the production of quality ceramic tiles, meeting the world standards, will stimulate the share of Indian tiles in the world market. But at the same time market information on export of the existing products to under-developed countries should also be explored as in the case of sanitarywares which are being exported at a large scale to Middle East and African countries.

Shri Sahijwani, Managar, SIDBI, informed that the Government of India is providing funds for modernization of cluster development, technology upgradation in SSI sector, setting up of common facilities, showrooms within the country and outside, participation in national and international exhibitions & fairs, etc.

HRD and Other Issues

The efforts being made by CGCRI in the area of human resource development in the SSI sector were lauded. The experts focussed that the topics related to recycling and utilization of solid wastes generated by the industry as well as utilization of waste heat have their own merits, but more important is to reduce the percentage of rejects. A strong plea was made by the experts to increase the limits of exemption for sales tax and excise tariff as this would benefit the State in the long run by way of increased returns due to modernization.

Shri R.J. Shah, Chief Industrial Adviser, while summing up, complimented CGCRI for its role in the development of ceramic industry in the SSI sector. He assured the entrepreneurs that the State Government would extend all help to the units for modernization. ❑

HONOURS & AWARDS

Prof. A.K. Gupta

THE American Biographical Institute (ABI), North Carolina, USA, has conferred upon Prof. A.K. Gupta, Director, Central Road Research Institute (CRRI), New Delhi, the distinguished honour of 'International Sash of Academia'.

This honour by ABI is one of the latest in the series of honours received by Prof. Gupta. The ABI honours received by him earlier include select few in who's who, man of distinguished stature, fellowship of the ABI Research Association (1995-96), and Deputy Governorship of ABI (1995-96). The present honour represents one of the highest forms of respect for individuals in the society. The letter of offer mentions: "This Sash is a distinguished emblem of rank as well as a magnificent form of attire. It is a symbol of prestige that will be awarded to only a select few this century. Congratulations on being one of the very small number recommended for this honour".

Dr Sajid Husain

DR Sajid Husain, Deputy Director and Head, Analytical Services, Indian Institute of Chemical Technology(IICT), Hyderabad, has been nominated as a member on the panel for Chemical Testing Laboratories by the National Accreditation Board for Testing and Calibration Laboratories, NABL Sectt, Department of Science & Technology, New Delhi, for a period of three years.

As a member, his job will be to evaluate the assessment reports of the assessed laboratories and give his final recommendations for grant of accreditation by the Chairman, NABL. The panel will also identify the experts in different areas of chemical testing and recommend them for the training imparted by NABL.

President of India presents Atma Ram Award to Shri T.P. Pathak

SHRI T.P. Pathak, Scientist EII and Editor, *Bharat-Ki-Sampada, Raw Materials*, National Institute of Science Communication (NISCOM), New Delhi, has been awarded the Atma Ram Award for excellence in writing in the area of S&T Literature and Equipment Development for 1996. He received the Award from the President of India Dr Shanker Dayal Sharma at a glittering function held at Rashtrapati Bhawan, New Delhi, on 5 December 1996.

This award, named after Late Dr Atma Ram, an ex-Director General, CSIR, who played a significant role in strenghthening the foundation of science writing schemes in Hindi at the national level, is channelized through Central Institute of Hindi, Agra, under the Union Ministry of Human Resource Development. It carries a cash prize of Rs 15,000, a citation, a plaque and a shawl.

Shri Pathak has made significant contribution to agricultural literature and scientific literature for children. In addition to editing nine volumes and two supplements of *Bharat-Ki-Sampada*, Shri Pathak has written more than a dozen original science books, more than 100 popular science articles, and two glossaries of Scientific Terminology. He has also translated and edited several books and contributed science course material (e.g. for NCERT) and two directories on Science & Technology literature in Hindi. He has not remained untouched with Radio and Television. He has given more than 100 scientific talks, and also conducted the programmes 'Vigyan Charcha' & 'Vigyan Patrika' in addition to Radio serial 'Manav Ka Vikas', etc. The TV programmes in which he has taken part include 'Gyandeep', 'Paryavaran', 'Krishi Darshan' and 'Jan Chetna'.

He is associated with several associations including the Indian Science Writers Association, and has been awarded by a number of organizations including Vigyan Vaichariki Academy, CSIR and NCERT.

Shri T.P. Pathak, Scientist, NISCOM, New Delhi, receiving the Atma Ram Award from President of India Dr Shanker Dayal Sharma

Dr G. Prathap

DR G. Prathap of the Structures Division, National Aerospace Laboratories (NAL), Bangalore, has received the Aeronautical Society of India's Distinguished Alumni Award for Aeronautical Engineering from IIT, Chennai. Dr Prathap was a B. Tech. student at IIT, Chennai, during the period 1969-74.

Also, Dr Prathap has been invited to serve as Member, Editorial Board of the new journal *Computer Modelling and Simulation* being published by the Sage Science Press.

Dr Sekhar Majumdar and Ms B.N. Rajani

DR Sekhar Majumdar and Ms B.N. Rajani, CTFD Division, NAL, are the 1996 recipients of the Dr M.G. Deshpande Memorial Award for Best Paper (in the category of R&D establishments and academic institutions) awarded by the National Society for Fluid Mechanics and Fluid Power. The award, for the paper titled *Numerical computation of incompressible turbulent flow in complex configurations*, was announced at MACT, Bhopal, at the Society's meeting held during 27-29 December 1996.

Dr J.R. Raol

DR J.R. Raol, Flight Mechanics & Control Division, NAL, has been elected Fellow of the Aeronautical Society of India. ❑

ANNOUNCEMENTS

Fourth NAL - CAE Workhsop

Advanced Gas Turbine Technologies - I (Turbomachinery)

Background

A protocol for scientific and technical co-operation between the Chinese Aeronautical Establishment (CAE), China and the National Aerospace Laboratories (NAL), India, in the area of Civil Aviation was signed on 5 August 1994. The subsequent NAL-CAE Joint Committee Meetings recommended holding of NAL-CAE workshops in the areas of mutual interest. The first workshop on Aerodynamic & Propulsion was held in Bangalore during January 1995; the Second Workshop on Composites & Fatigue/Fracture was held in China during August 1995; and the Third Workshop on Composites was held in Bangalore during April 1996. All these workshops provided expert fora for exchange of relevant technical information between the two countries and unfolded opportunities for detailed mutual discussions on the state of art technologies in aerodynamics, aeropropulsion, aircraft materials and structures. The Fourth NAL-CAE Workshop on Advanced Gas Turbine Technologies- I (Turbomachinery) is proposed to be held in NAL, Bangalore, during June 1997.

Scope

The workshop will focus on the recent trends and emerging technologies in gas turbines with par-

Refresher courses/training programmes during 1997-98 at CRRI.

THE Central Road Research Institute (CRRI), New Delhi, will be conducting the following refresher courses/training programmes during 1997-98.

S.No.	Refresher Course/Training Programme	Period	Course Fee
1.	Refresher Course in Highway Engineering	23 April-13 May 1997	Rs 4500
2.	Training Course on Use & Maintenance of Automatic Road Unevenness Recorder/ Profilograph/Bump Integrator and Introduction to other Related Devices	4-10 June 1997	Rs 1500
3.	Training Programme on Rural Road Technology and Soil Stabilization	18-24 June 1997	Rs 1500
4.	Training Programme in Elastomeric Bearings for Bridge Design Engineers	9-15 July 1997	Rs 1500
5.	Training Programme on Road and Embankment on Soft Grounds	23-29 July 1997	Rs 1500
6.	Refresher Course in Traffic & Transportation Engineering	13 August - 1 September 1997	Rs 3000
7.	Refresher Course for Senior Highway Engineers	10-23 September 1997	Rs 3000
8.	Refresher Course in Bridge Engineering	8-14 October 1997	Rs 1500
9.	Training Programme in Procedures of Material Testing & Quality Control Techniques of Highway Construction	22 October - 6 November 1997	Rs 3000
10.	Training Programme on Design, Construction, Quality Control & Maintenance of Cement Concrete Roads	17-21 November 1997	Rs 1500
11.	Training Course on Use & Maintenance of Automatic Road Unevenness Recorder/Profilograph/Bump Integrator and Introduction to other Related Devices	3-9 December 1997	Rs 1500
12.	Training Programme on Pavement Maintenance, Management System	17-23 December 1997	Rs 1500
13.	Training Programme on Design, Construction, Quality Control & Maintenance of Bituminous Surfacing of Roads and Runways	7-20 January 1998	Rs 3000

For further information please contact:
R.S.Bharadwaj
Head
Information, Liaison & Training
Central Road Research Institute
Delhi-Mathura Road, P.O. C.R.R.I.
New Delhi - 110 020

Telephone: 6839923
EPABX: 6832173 6832427 6832325
Ext.: 390 391 392
Fax: 91-011-6845943
Telex: 031-75369 CRRI IN
Grams : ROADSEARCH
Email: crri @ sirnetd. ernet. in □

ticular reference to turbomachinery. Other leading Indian organizations in the field are also invited to participate. In addition to invited talks, there will be contributed papers, to be presented and discussed, on the following topics:

- Fans/compressors
- Turbines (including blade cooling)
- Cascade testing
- CFD in turbomachines
- Advanced materials
- Rotor dynamics
- Stress analysis
- Measurement techniques

Further details can be had from: Shri Q. H. Nagpurwala, Convener, Fourth NAL-CAE Workshop Advanced Gas Turbine Technologies - I, Propulsion Division, National Aerospace Laboratories, Bangalore 560 017 (India).

Tel: 91-080-5279611

Fax: 91-080-5272494

e-mail: qhn @ cmmacs. ernet. in ☐

फार्म 4/FORM IV

[नियम 8 देखिए/*See* Rule 8)]

1. प्रकाशन स्थान/Place of publication	New Delhi
2. प्रकाशन की अवधि/Periodicity of its publication	Semi-monthly
3. मुद्रक का नाम/Printer's Name	Dr G P Phondke
(क्या भारत का नागरिक है?)/(Whether citizen of India?)	Yes
(यदि विदेशी है तो मूल देश)/(If foreigner, state the country of origin)	
पता/Address	National Institute of Science Communication Dr. K.S. Krishnan Marg, New Delhi 110 012
4. प्रकाशक का नाम/Publisher's Name	Dr G P Phondke
(क्या भारत का नागरिक है?)/(Whether citizen of India?)	Yes
(यदि विदेशी है तो मूल देश)/(If foreigner, state the country of origin)	
पता/Address	As above in (3)
5. संपादक का नाम/Editor's Name	Dr B.C. Kashyap
(क्या भारत का नागरिक है?)/(Whether citizen of India?)	Yes
(यदि विदेशी है तो मूल देश)/(If foreigner, state the country of origin)	
पता/Address	As above in (3)
6. उन व्यक्तियों के नाम व पते जो समाचार-पत्र के स्वामी हों तथा जो समस्त पूंजी के एक प्रतिशत से अधिक के साझेदार या हिस्सेदार हो। Names and addresses of individuals who own the newspaper and partners of share holders holding more than one per cent of the total capital.	

मैं, ________________ एतद्द्वारा घोषित करता हूं कि मेरी अधिकतम जानकारी एवं विश्वास के अनुसार ऊपर दिए गए विवरण सत्य हैं।

I, Dr. G.P. Phondke hereby declare that the particulars given above are true to the best of my knowledge and belief.

ता०/Dated 15 March 1997

Sd/- G.P. Phondke
प्रकाशक के हस्ताक्षर/Signature of Publisher

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

(Human Resource Development Group)

Advertisement No. SRF/RA-EMR-2/97

THIS is to bring to the attention of all concerned that CSIR has invited applications for awarding Senior Research Fellowships and Research Associateships vide an advertisement in 5 April 1997 issue of Employment News. Eligibility conditions and application proforma are published along with the advertisement. The application form may be cut out or copied from advertisement and used.

The last date of receiving applications is 5 May 1997. The application duly completed in all respects should be sent to the Deputy Secretary, Extra Mural Research Division, Human Resource Development Group, CSIR Complex, Dr K.S. Krishnan Marg, NPL Campus, New Delhi - 110 012. ☐

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit

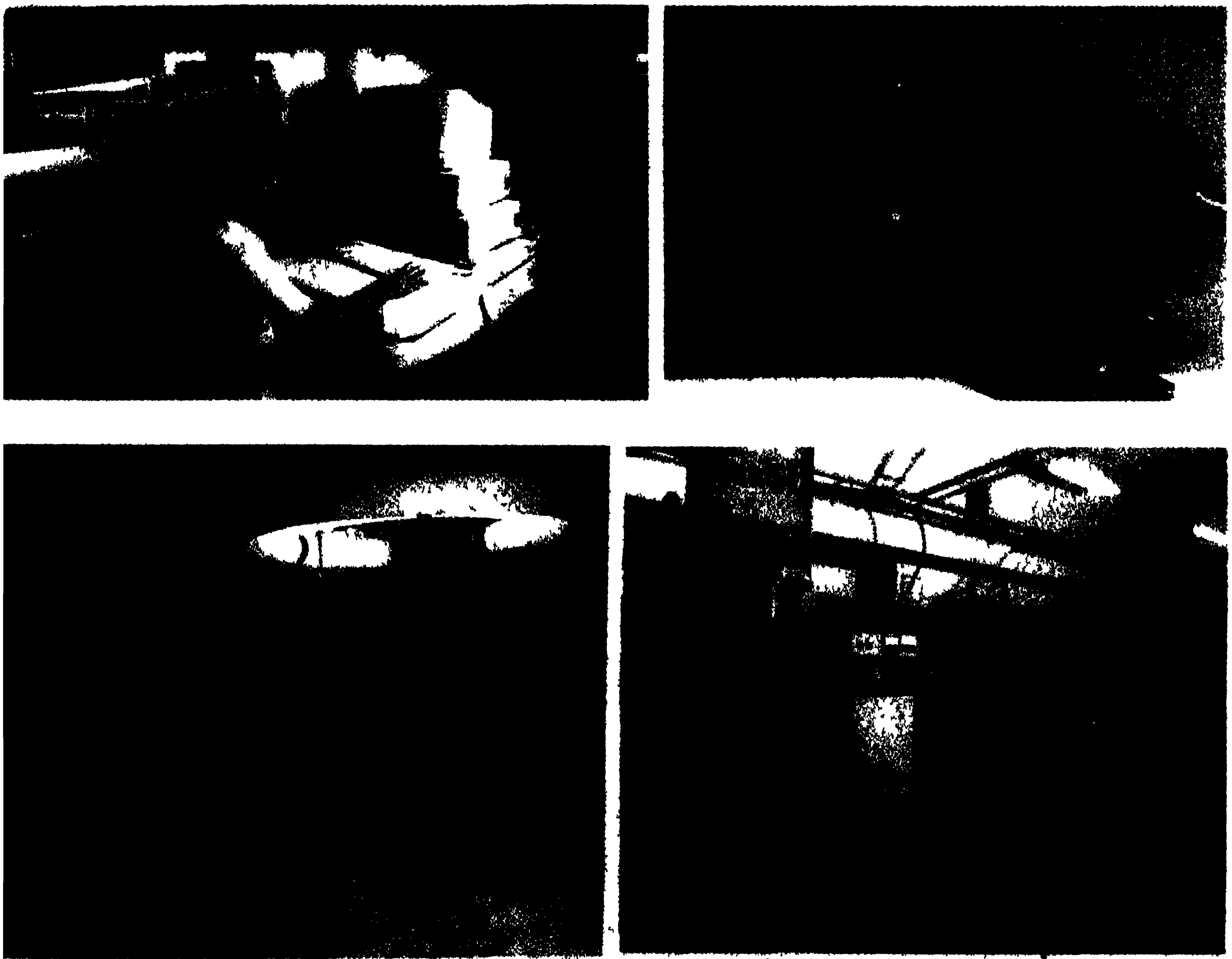
Annual Subscription : Rs. 60
Single Copy : Rs. 3.00

Editor : Dr B.C. Kashyap
Editorial Assistant : Neelima Handoo
Production : Kaushal Kishore

Phone : 5786301
Gram : PUBLIFORM
Telex : 031-77271
E-mail: niscom@sirnetd.ernet.in.
Fax : 5787062

ISSN 0409-7467

CSIR NEWS



R&D at Central Electronics Engineering Research Institute, Pilani: (*Clockwise from top right*) NICAM stereo receiver, Processing stations of microwave tubes, Assembly of gas discharge tube, and Retrofit automation of paper mill. A report on R&D accomplishments of the institute appears on p. 82.

CENTRAL ELECTRONICS ENGINEERING RESEARCH INSTITUTE, PILANI
R&D Highlights: 1995-96

THE R&D programmes of the Central Electronics Engineering Research Institute (CEERI), Pilani, are grouped under three broad areas: Electronic Systems, Microwave Tubes, and Semiconductor Devices. The main thrust of CEERI during the recent years has been directed towards collaborative/ grant-in-aid research projects funded by government departments and government-funded user agencies and, to a lesser extent, towards in-house development projects resulting in technological know-how which can be transferred to Indian industries. As a result of these efforts, the institute has succeeded in enhancing its external cash flow through such projects to quite a large extent. Out of the contract research projects worth Rs 85 million which were ongoing during 1994-95, projects worth Rs 30 million have been completed during 1995-96 and new projects of a total value of Rs 55 million have been started during this year. One of the two major projects initiated during the year is on the development of Specific Microwave Tubes, and the other, on Laser Device Packaging, both funded by the Government of India. These projects will attempt to bridge important gaps in the technology needed for crucial electronic devices in the country.

In the Microwave Tubes Area, work has continued in the ongoing contract research projects on 2 MW Tunable Magnetron, 5 MW Klystron, Gain and Phase Matched Travelling Wave Tube and Coupled Cavity Travelling Wave Tube. Working tubes have been developed under first of these four projects, which is nearing completion. The last two projects are also in the final stage of their trials and are expected to be completed next year.

In the area of Semiconductor Devices, three continuing major projects are on 68010 Compatible Microprocessor, Detector and Receiver for Optical Communication and High Power GaAs MESFETs. The first project is at its last stage of design and is expected to be completed after design verifications next year. The other two projects, both undertaken by the Optoelectronics Devices Group, have commenced last year and are making good progress.

In the Electronic Systems Area, the project on Digital Mapping has been successfully completed, with the installation of Digital Workstations at six locations of Survey of India. A new approach to the R&D methodology of the laboratory has been initiated through the Retrofit Automation of a paper mill, based on the instrumentation developed at the Madras Centre. It is expected that this will pave the way for further retrofit automation projects for paper and sugar industries, where CEERI has established expertise through years of R&D work.

An account of the group-wise activities/achievements of the institute during 1995-96 is presented here:

ELECTRONIC SYSTEMS

Agri-Electronics

The following systems have been installed under the Retrofit Automation Project at the Ahmedpur Sugar Mill: PC-based pan monitoring and *p*H control systems, temperature control systems (at different points), and 24-point panel for local display. Appropriate modifications have been made in the juice sulphiter for *p*H sampling points and the control valves for milk of lime and sulphur dioxide have been commissioned. An electro-magnetic flow meter in the juice pipeline has been commissioned and interfaced with the PC monitoring. Monitoring and control software for the above unit operation has been incorporated.

A monitoring and control system for tealeaf withering process has been developed and tested at Mohorgong and Gulma Tea Estate. This system has a stepper motor-based control valve for hot air feed, fan direction and duty cycle control with required interfacing hardware and application software, temperature and RH sensors for improving the accuracy and repeatability, and rule- based software for withering control. Modifications have been made in the moisture sensor for assuring uniform withering of leaf.

Communication Engineering Delhi Centre

The design of a 256-line EPABX with the following features has been completed: A 16-bit microcontroller is the main processor for the system; each subscriber card has the DTMF pulse dialling detection capability using an 8-bit microcontroller; and apart from normal tones such as dial, ring back and busy tones, provision has been made for the synthesized voice signals.

An Energy Meter Monitoring System has been developed under a project sponsored by M/s Contimeters and Electricals Pvt Ltd, New Delhi. The system has been continuously tested at the lab and is now ready for installation at the site of the sponsor.

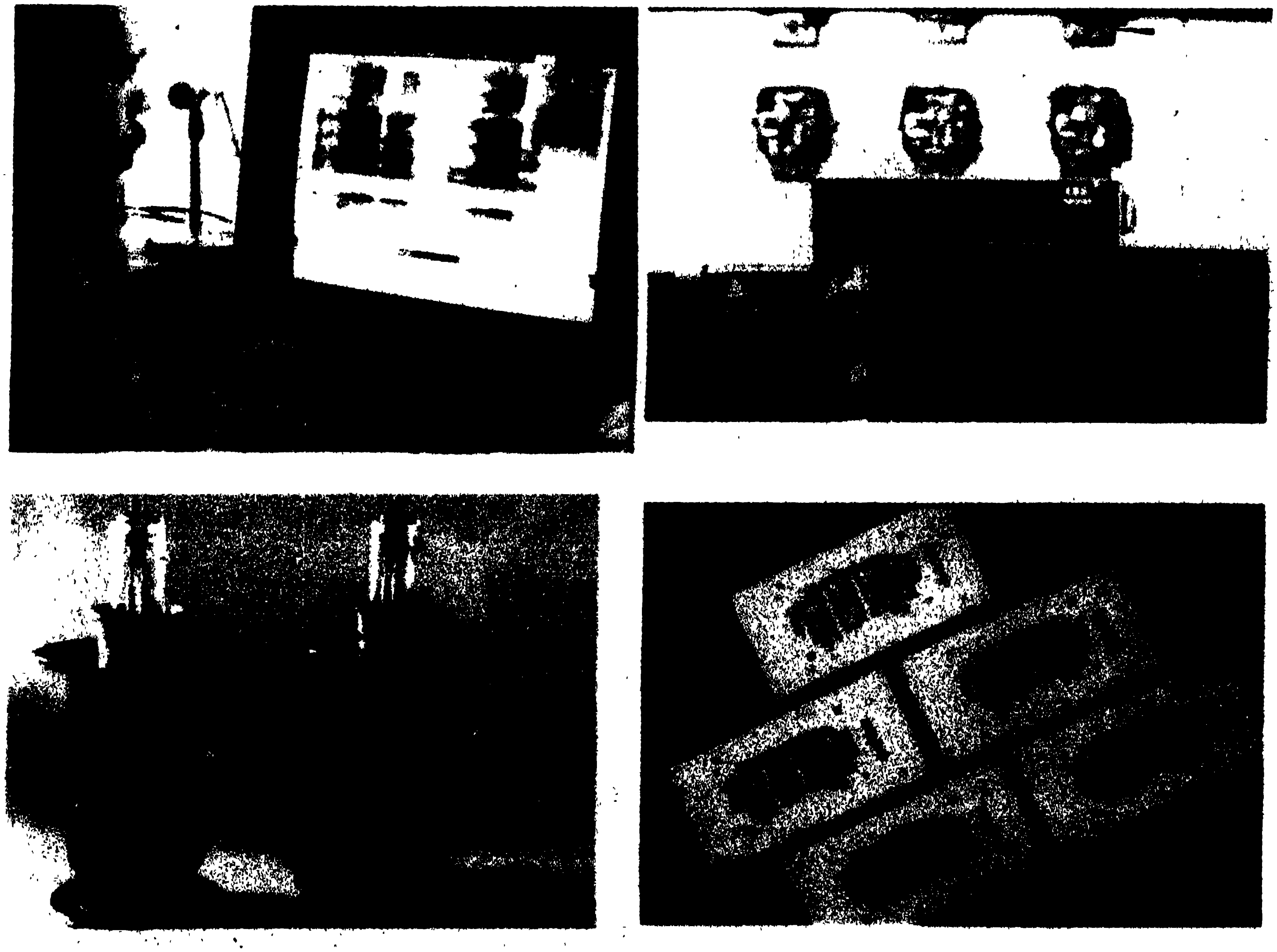
Some significant features of this system are: Forty electric meters can be tested at a time for error with respect to a standard meter, and the percentage error for each meter displayed; Error readings for each meter can be stored; Calculation of percentage of error can be selected at 2, 5 or 10 RPM and the meter can be tested over the range of 200% to 5% of rated current.

Digital Systems

A NICAM (Near Instantaneous Companding) decoder has been developed and interfaced with a commercial TV set. The system has been tested successfully, first by using the NICAM pattern generator available at SGS Thomson Microelectronics, Noida and, later, using the NICAM transmitter at Doordarshan Kendra, Madras.

In the Integrated Receiver Decoder project, specifications of chip to be used for the hardware schematics have been finalized.

NRDMS (Natural Resource Data Management System) group of DST has been granted a UNDP project on GIS (Geographical Information System) based technologies for local development. CEERI has been awarded to complete the task of GRAMNET (Geo Referencing Area



Clockwise from top right: Energy meter monitoring system, Alumina bias circuit board, 2MW pulsed tunable magnetron, and High-quality synthesis of Hindi speech

Management System). An object-oriented analysis of GRAMNET has been completed.

Under the Profibus Compatible Smart Transmitter project, specifications finalization, user interface design, hardware schematic and software algorithms have been completed.

One prototype unit of RF-head for the SQUID developed at NPL, New Delhi, has been successfully completed and the same has been certified by NPL.

All activities under the Digital Mapping project have been completed, including training of 12 operators.

A precision helix pitch measurement system has been developed, and the institute's Microwave Communication Tubes Group is using the same.

The Rapid Thermal Processing (RTP) System has been interfaced with PC. The RTP has been tested with elevated platform with 12 lamps. It reached its peak temperature 900°C in 12 seconds.

Industrial Electronics

An energy efficient DC drive for mining locomotive has been designed, developed and fabricated. It was taken for field trials to an underground mine of Hindustan Zinc Limited. Installation and commissioning have been completed and the system has been operational since March 1996.

A new technique has been developed for tacholess speed measurement of induction motors. Rotor slot harmonics have been used for indirect speed measurement of induction motors.

The temperature controller for the RTP system prototype has been fabricated and tested for performance. Temperature gradient of 80°C/s has been achieved. Fast dynamics and repeatability required for RTP has also been achieved.

Instrumentation Systems (Madras Centre)

Retrofit automation programmes have been undertaken at two paper mills: (i) Siddharth Paper Mills, Dharuhera and (ii) Mysore Paper Mills, Mysore, to monitor the critical process parameters during the paper manufacturing process. The complete system includes the following modules: O-Frame System, High Consistency Monitor, Moisture Sensor, Low Consistency Monitor and Caliper Sensor.

A brightness, colour and strength monitor based on the PC-based colour matching system for paper samples has been developed. This has been installed at Siddharth Paper Mills, Dharuhera.

Brix monitor for tomato concentrates and pulps has been developed. A table model cell has been fabricated. Testing of the sensor has been done with different sugar solutions.

A high performance TMS 320C30-based DSP board has been developed for IBM PC-AT computers with relevant software.

A process control system for leather finishing chemicals plant has been installed, commissioned and calibrated at M/s Excel Enterprises, Hyderabad.

Microprocessor-based product mixer for leather industry has been developed for M/s Quinn India Ltd, Hyderabad. The integrated system was tested in the lab and demonstrated in the International Leather Exhibition held at Madras.

Under the agreement between BCMM, Brunel University (UK) and CEERI Madras Centre, a sensor for automatic brix measurement has been developed for food products.

Speech Technology (Delhi Centre)

The work on development of a Voice-operated Wheel-chair was continued, and improvements concerning the following work made:

Rejection of audio noise caused by the initial movement of D.C. motor, etc.; Acceptance of any loud audio signal as stop command; and LED display scanning programme for better recognition.

Work has been carried out for recognition of Hindi vowels occurring in 4 different phonetic contexts, which is useful for text-independent vowel recognition.

The following new techniques have been developed to improve the performance and reliability of the Isolated Word Recognition/Verification System: Technique for compressing the data of spoken words by a ratio of 200:1 by representing the template of a spoken word by 16 bytes; and technique for rejecting any new word which does not lie in the reference vocabulary.

The achievements in the project on 'Text to Speech Conversion' include synthesis of some more basic speech units and development of rules for syllable concatenation. Among these the following are important: Rules to convert long vowels /a/, /u/ and /e/ into respective short vowels; Rules to synthesize germinates from non-germinates;

Durational rules from smoothing the discontinuities at the junction of two syllables; and Rules for elimination of sharp change in frequency at the junction of two syllables.

A software package (Parser) in C++ has been developed to segregate a simple word into mono-syllable and to concatenate files from the basic units, available in the database.

MICROWAVE TUBES

Communication Tubes

The latest prototype of Gain and Phase Matched Mini-TWT (GPMT-3) has delivered a minimum of 25 W RF output power over the frequency band 7.5-18.0 GHz and 40 W power at 12.0 Ghz.

The minimum gain of the TWT is > 35 dB over the entire frequency band. As per specifications, the tube has to give minimum 40 W power throughout the band with 40 dB gain.

The first prototype TWT has also been developed. An R&D agreement has been signed between CEERI and SAMEER, Mumbai, for the development of TWT power supply for testing this TWT.

Vacuum compatibility of kanthal coating on OFHC copper rings through mass spectrometry has been carried out.

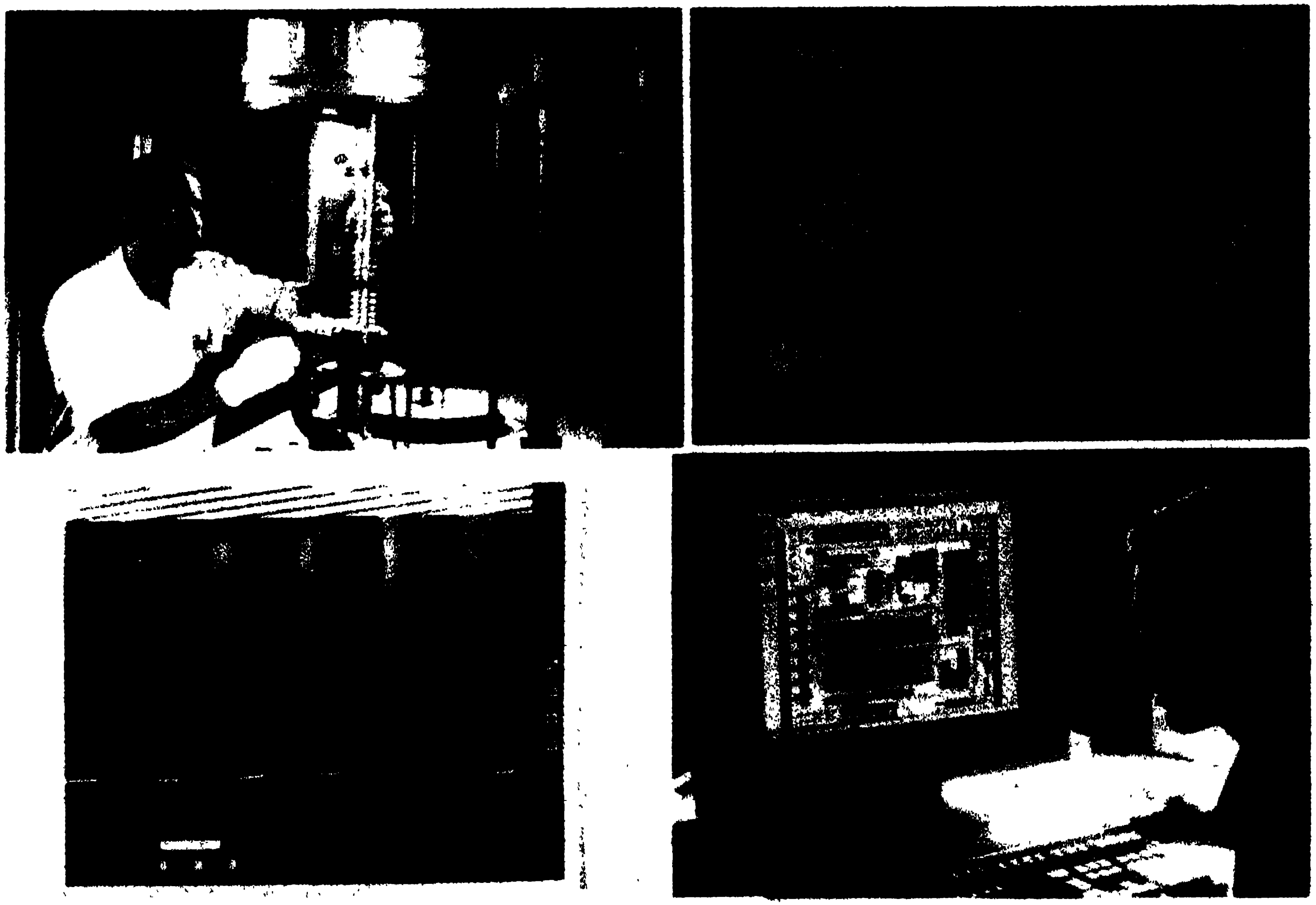
Surface analysis of Si_3M_4 PECVD deposited film on seven samples has been carried out with auger electron spectroscopy.

Contacts have been established with ISRO for design and development of space qualified TWTs in collaboration with Bharat Electronics, Bangalore.

Industrial Tubes

The grant-in-aid project on development of 2MW pulsed tunable magnetron has been completed with the supply of two tubes to CAT, Indore.

2MW Pulsed magnetrons were processed and assembled at CEERI,



Clockwise from top left: Coupled cavity TWT, 600 A 4.3 KV rectifier, Computer-aided VLSI design, and Silicon microchannel formed by anisotropic etching and tested at CAT, Indore. Results achieved have met all the required specifications — Power ouput : 2.3 MW, Frequency : 2.992 - 3.002 GHz, and Band width : 10 MHz).

The gun collector test module for 5MW pulsed S-band klystron was subjected to tests at CAT, Indore up to 60 kV and found to be working satisfactorily. The purveyance of the electron gun was found to be very close to the designed value (~2.0 micropurveyance). The design of RF interaction region has been finalized and cavity and cooling jacket designs modified for ease of fabrication. The output window has been successfully brazed and found to have satisfactory characteristics in respect of its insertion loss, return loss, and bandwidth.

The design of magnetic focussing system has also been finalized and sent to CAT, Indore. The fabrication of collector for the first lab prototype has been completed.

A new project on development, testing and pilot production of specific microwave tubes and gas discharge tubes has been approved by Government of India and a sum of Rs 27 million sanctioned as grant-in-aid for the project.

Plan for setting up of klystron processing and testing facilities has been prepared and work started towards its execution. Purchase of infrastructural equipment has been initiated.

For specific gas discharge tubes, design of cathode, tube processing station, baking ovens, etc. have been finalized. Engineering drawings of all the sub-assemblies have been prepared. The specifications of the pulse test set-up have been finalized. Work on the development of techniques for fabrication of reservoir heater, anode and grid sub-assemblies has been initiated.

SEMICONDUCTOR DEVICES

Device Processing

Equipment for fine-line metal etching has been installed. All the utilities like gas, exhaust, power and gas scrubber have been connected to the system. A number of plasma processes have been run on the system for etching of silicon dioxide and aluminium with various combinations of process parameters.

The design of a set of reticles for use on wafer stepper has been completed. The design contains various alignments, windows and fiducial marks for aligning the reticle on to the reticle plates, wafer stage and in-process wafer. The strategy for placing these marks at different mask levels has been worked out. PG tape has been generated for CD 4000 like circuits. The design is compatible with the in-house CMOS process.

Hybrid Microcircuits

Relay driver hybrid microcircuits (HMCs) have been batch-produced and 53 units supplied to ISRO for use in INSAT-2D satellite. Layout of test pattern was designed for recertification of process line and revised process identification document has been approved by ISAC. Two types of HMCs have been developed and batch-produced up to resistor laser trimming stage and handed over to user agency, as per their requirements.

A batch of 20 samples of alumina Bias Circuit Board for infrared detector has been developed and handed over to SPL, Delhi.

Specifications of laser system for optical fibre attachment and sealing of packages are being carried out. Equipment, materials, etc. required for this project are being finalized.

A novel and low-cost technique has been developed for conductor fabrication for power thick-film hybrid microcircuits/microwave integrated circuits, and a patent on the same is being processed.

IC Design

Design of all the constituent blocks of the telecommunication microprocessor using hardware description language VHDL has been completed.

Training courses on VLSI Design and IC Fabrication-Technology and Related Topics have been conducted for engineers of: M/s Usha-Matra Ltd, Gurgaon, and M/s SGS Thomson Microelectronics Noida and M.E. (Microelectronics) students of BITS, Pilani, and M. Tech. students of IIT, Delhi.

Microwave Devices

Anisotropic etching of silicon microchannel has been established and silicon microchannel structures have been fabricated out of <110> silicon. 300 µm deep, 50 µm wide channels with equal separation have been realized using KOH etchants.

Chilled water flow manifold has been successfully cut in pyrex glass using ultrasonic milling machine.

Preliminary experiments on glass to silicon anodic bonding have been carried out successfully using heated stage of die bonder and high-voltage power supply. After parameter optimization of glass to silicon anodic bonding, silicon microchannel heatsinks have been anodically bonded to pyrex glass manifold.

Optoelectronic Devices

Design and technology of hybrid PIN/FET optical receiver suitable for long haul optical communication system has been established, and modules developed at CEERI have been successfully tested at 68 Mbps at C-DoT, Delhi.

Design of C-Band 2.5 W GaAs power MESFETs and related unit processes such as enhanced lift-off, ohmic contacts and dielectric layer deposition especially suited for power FET applications have been optimised.

A multizone Plasma Enhanced Chemical Vapour Deposition (PECVD)/ Reactive Ion Etching (RIE) system has been indigenously designed and fabricated jointly with NPL. The system has now been installed at CEERI and become operational for compound semiconductor device fabrication.

Power Devices

The project on development of high current and High Voltage rectifiers has been successfully completed. Meant for railway locomotives, this rectifier has an average forward current of 600A with a forward voltage drop of 1.1V at 1800V and a peak repetitive reverse voltage of 4300V. This project was jointly sponsored by DoE and Usha India. Design capability of high voltage large-area diode has been demonstrated.

The technology has been developed by optimizing process for deep diffusion, Mo-Si alloying and surface electric field control using positive level contouring, spin etching and passivation.

New Projects taken up and technologies transferred by NML

THE National Metallurgical Laboratory (NML), Jamshedpur, has taken up the following new projects:

- **Development of wear-resistant ceramics from fly ash (NALCO, Bhubaneswar)**
- **Beneficiation of low-grade limestone (ACC, Chaibasa)**
- **Corrosion characteristics of steel bars (Tata Steel)**
- **Recovery of copper powder from waste solution (Grishma Metal Tech, Mumbai)**
- **Development of low-cost bamboo composites as structural material (ARDB)**
- **Studies on separation and recovery of base and noble metals from anode slime (CSIR-EMR Project with Jadavpur University)**
- **Reduction in pollution and acid consumption in pickling shop of Tubes Division (Tata Steel)**
- **Pelletization of mica concentrate (HZL)**
- **Studies on surface imperfections of wire rod products (UMIL)**
- **Failure analysis of water wall tube (Neyveli Lignite)**
- ***In-situ* metallography and hardness at selected points of boiler No.4 (CESC)**
- ***In-situ* metallography at selected points of boiler and turbine assembly (U2) (Super Thermal Station, NTPC)**
- **Residual life assessment of one unit of Maithon Hydel Power Station (DVC)**
- **Characterization of seven types of iron ores (Raw material Div., SAIL)**

The NML technologies transferred to the industry in the recent past include:

- **Technology for recovery of copper powder from waste solution has been transferred to M/s Grishma Metal Technology, Mumbai.**
- **Technology for production of extra fine aluminium powder has been transferred to M/s Eastern Engineering and Foundry Co., Jamshedpur.**

NML has signed memoranda of understanding with the following industrial/business partners: M/s Grishma Metal Technology, M/s Eastern Engg. & Foundry Co., M/s SAIL, M/s DVC, M/s Fertiliser and Chemicals Travancore Ltd (New Projects); National Testing & Research Lab, and Mr K.N. Gupta, Consultant, Canada (Business Development). ☐

Semiconductor materials

All the CVD systems (APCVD, LPCVD-polysilicon, LPCVD-Si_3N_4 and PECVD) have been installed in the new CVD laboratory and made operational for deposition of films. PECVD silicon-nitride process, based on silane and ammonia chemistry, has been developed. Si_3N_4 films deposited by PECVD have been characterized by FTIR, SMS and AES for standardization of process parameters.

Thin-film humidity sensors using Al_2O_3 have been fabricated, characterized and demonstrated for user application in agro-based industry. Further work is being continued for field trials.

STM/AFM investigation of Si/SiO_2 interface and ZnS, CdS nano- particles has been carried out.

Fabrication of silicon varactor diodes for TV tuner has been completed. Double implantation process has been optimized to fabricate hyper-abrupt junction. Batch production of diodes has been done to estimate yield and to examine viability of the process for manufacturing diode on a large scale. Five batches, each of six wafers, have been processed with each wafer having about 20,000 diodes. These varactor diodes gave the C-V characterstrics necessary for use in TV tuner. The packaged varactor diodes have been tested in a TV tuner circuit, which exhibited gain equivalent to commercial diodes in channels I,II and III. ❑

Meet on Future of Indian Salt Industry & Avenues for R & D

A one-day meet was organized on 30 December 1996 by the Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar. The meet was co-sponsored by Tata Chemicals Ltd, Mithapur; Gujarat Heavy Chemicals Ltd, Bhavnagar; and Indian Chemical Manufacturers Association, Mumbai. About 80 delegates from salt, chlor-alkali and marine chemicals industry and different states commissionerates participated in the meet. The main objective of the meet was to bring the salt industry and user industries on a common platform to discuss the problems and prospects of the large-scale salt works, export potential and to identify the role of CSMCRI in the above aspects.

The meet was inaugurated by Shri R. Sellamuthu, IAS, Chairman and Managing Director, Tamilnadu Salt Corporation. Shri Sellamuthu in his speech mentioned that the Indian salt industry has achieved the salt production targets which should make it feel comfortable. But the present requirements of quality salt for edible as well as for industrial purposes pose some problems to the salt industry and user industries. He said that such problems can easily be solved through industry-institute interaction at such meetings. Such interaction is necessary for meeting the international challenges. He felt that the internal salt market for both edible as well as industrial consumption is saturated, and it cannot be stretched beyond its elastic limit. Future of salt industry lies in its ability to get integrated with user industry, to collaborate and become partners with the research institutes for development of new products, e.g. fortified salts, etc. He also called upon scientists to work with industry. He pointed out that Australia is exporting about 50% of its production because it has advantage of the scale of economy. Geographically India is also well placed to compete in the international salt market.

Dr P. Natarajan in his Presidential address mentioned about the need for quality salt production and export potential for industrial salt. He mentioned that there is potential of exporting more than 2-3 million tonnes of salt, for which all the agencies should coordinate their efforts. Speaking about the large-scale export-oriented salt works, he said that these salt works can have the benefit of scientific layout and design, lower cost of production due to mechanization and other advantage of large-scale units.

In the two technical sessions that followed two key-note addresses were delivered: (i) The problems and prospects of large-scale salt works, and (ii) Salt quality for environment protection and energy efficiency.

Dr Gomkale, Scientist Incharge, presented a paper on 'Salt Industry and CSMCRI'. Shri K.M. Majeethia, Scientist F, presented the summary of views of the salt, chlor-alkali and marine chemicals industry and forwarded to the institute. Shri R.N. Vohra, Scientist F, helped in conducting the two sessions. Both these sessions had interesting and informative discussions.

The concluding session was chaired by Prof. P. Natarajan. The following observations/recommendations were made:

(i) Salt quality requirement by the industry should be specified. The consensus of the salt industry is that the user industry does not pay reasonable price for the quality salt. The user industry and salt industry will solve this commercial problem by mutual discussions.

(ii) Salt industry in different states has different problems. A status report of salt industry in each state should be prepared by the Salt Department, indicating the problems. Such report should be made available to CSMCRI which will help the institute in solving such problems.

(iii) Large-scale salt units are self-sufficient and generally produce salt for their captive consumption. Such units can afford R&D expenses. CSMCRI should help the small- and medium-scale salt industry.

(iv) Based on the status reports from Salt Department, projects may be planned. Mission programmes for large-scale salt works for export-oriented units may also be planned.

(v) Mechanization in large-scale salt industry may be carried out in phases so as not to disturb the labour force.

(vi) 'Salt Directory' of salt manufacturers and a quarterly 'Salt Newsletter' should be published. Salt Department should take up this task.

(vii) CSMCRI should take up the quality improvement projects for lake brines salt from Rajasthan.

The salt industry suggested to organize such meetings in Jamnagar and Gandhidham. Salt Department also suggested to organize such meetings outside Gujarat.

Press Conference

A press conference was also organized on a day before the Meet wherein the CSMCRI Director briefed the journalists about the contribution of his institute as also the questionnaires sent to Indian salt manufacturers and alkali manufacturers, for seeking their views. While highlighting the recent achievements of the institute he told that CSMCRI had received a handsome grant of Rs 35.1 million for its new laboratory building. More than 25 journalists attended the conference. ☐

Processes Licensed and Sponsored/Consultancy Projects taken up by CECRI

THE Central Electrochemical Research Institute (CECRI), Karaikudi, has licensed its processon Epoxy polymethylene coating over concrete to Grand Polycot, Vadodara (lumpsum premium Rs 150,000, recurring royalty 2.5%, period of license 7 years).

The sponsored projects taken up recently include: (i) Platinum plating on titanium expanded spirally wound mesh structure (IGCAR, Kalpakkam; Rs 303,600); (ii) Organic molecular magnets (DST, New Delhi; Rs 731,500); (iii) Study of the corrosion of hand pumps and bore tube in waters of Ammanampallam/Velavapatti areas and to suggest suitable system (UNICEF, Madras, Rs 175,000); and (iv) Recovery of chromium value from solid residue from chromite plant (Ministry of Environment & Forests; Rs 685,000).

The consultancy projects taken up include: (i) Suggestion of suitable chemical treatment for prevention of corrosion in fire hydrant lines (IOC, Madras, Rs 60,000); and (ii) To instal a suitable control and monitoring system for cathodic protection to the 200 mm naphtha pipeline, (IOC, Madras, Rs 127,400).

Technical services taken up are: (i) Analysis of silver foil and powder (High Energy Batteries, Mathur; Rs 10,000); (ii) Testing of oganophosphonate samples for carbonate scale formation control (NLC, Neyveli; Rs 15,000); and (iii) Evaluation of susceptibility to inter granular corrosion behaviour of HVD-1 stainless steel (FMC Scanmar Ltd, Viralimalai; Rs 15,000). ☐

CIMAP develops Herbal Anti-crack Cream

THE Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, has developed a natural wax-based herbal formulation effective in the treatment of cracks of hands and heels. Cracks are linear cleavage of skin. The skin opens up at the site of cracks. The infection of the cracks often leads to much pain and bleeding. The most common site for the development of cracks is sole (known as *'bivai'*). Other sites are palm, face, neck, ankle, etc. The cracks of the hands, feet and junction of lips are very common, especially among villagers and housewives.

With a view to developing cure/remedy for this debilitating disorder, different formulations were tried at CIMAP, leading to the development of a formulation which contains plant extracts and natural waxes that have wound-healing and anti-bacterial properties. The preliminary trials of this anti-crack formulation have been conducted by CIMAP on more than 100 persons. The results obtained indicate that itching and pain get cured completely with 1 or 2 applications and the skin becomes soft in 1 to 3 applications. The cracks of moderate size get healed completely within a week on regular application of cream, twice a day. The herbal cream when applied to the site of the crack spreads smoothly, restoring the natural softness and suppleness of the skin. Some of the users have found the CIMAP crack cream a wonderful product as it cured their ailment troubling them for decades. CIMAP has chalked out a programme for conducting elaborate clinical trials with the help of government hospitals of the state, besides dermitoxilogical testing in collaboration with the Industrial Toxicological Research Centre (ITRC), Lucknow. ❑

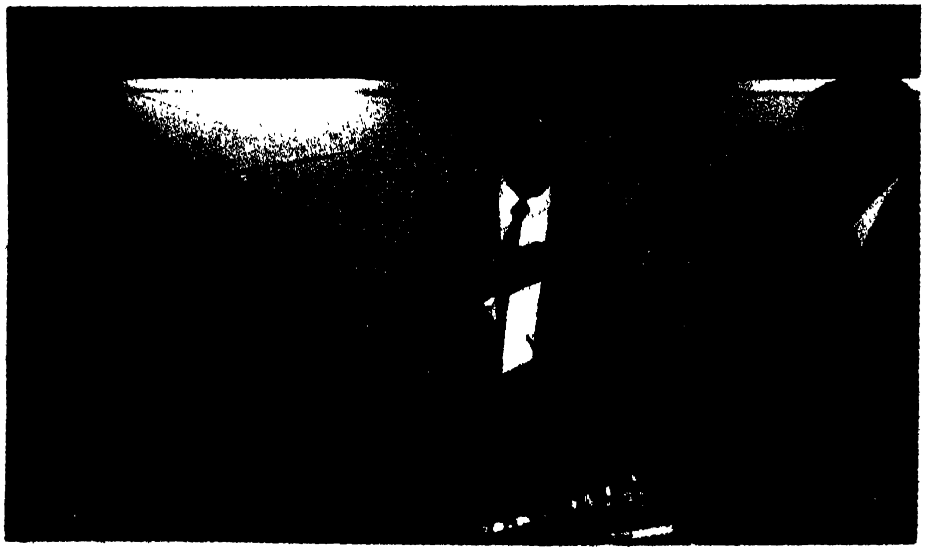
NISTADS-ORSTOM Project

Scientific Communities in the Developing World

A book on *Scientific Communities in the Developing World*, edited by Jacques Gaillard, V.V. Krishna and Roland Waast and published by Sage Publications, New Delhi, was released by Dr R.A. Mashelkar, Director General, CSIR, on 18 February 1997 at the CSIR Headquarters auditorium. Prof. M.G.K.Menon, Chairman, NISTADS Research Council, participated in this meeting and introduced the volume to the audience.

Welcoming Dr Mashelkar, Prof. Menon, editors of the volume and the audience, Dr Ashok Jain, Director, National Institute of Science Technology and Development Studies (NISTADS), New Delhi, pointed out that this volume is the outcome of a collaborative project on 'Emergence of Scientific Communities' between Dr Krishna (NISTADS) and Dr Waast and Dr Gaillard of ORSTOM (French Institute for Scientific Research and International Cooperation), Paris, which commenced in 1991-92.

Studies under the project were made on the social, economic and political problems underlying the emergence of scientific communities and their potential in addressing the problems of development. The publication embodies twelve countries' case studies covering China, India and Thailand from Asia; Algeria, Egypt, Nigeria, Kenya and Senegal from Africa; and Argentina, Brazil and Venezuela from Latin America, and for the first time, unfolds the status of scientific communities and their historical growth in a single volume, he added.



Dr R.A. Mashelkar, Director General, CSIR, releasing the publication: *Scientific Communities in the Developing World*, at the CSIR Auditorium, New Delhi. Others seen in the picture (from left) are: Dr J. Gaillard, Prof. M.G.K. Menon, Dr Ashok Jain, and Dr V.V. Krishna

Releasing the volume, Dr Mashelkar observed, "All of us refer to the term *scientific communities* on several occasions. It is interesting to note that the editors of this volume have sought to define this term from a sociological perspective at various levels of its usage -- international, national and local contexts. It is not just the numbers and material resources that define the existence of a scientific community or a specialist group of researchers. The relevant basic indicators are: steady production of knowledge in a specific field, constitution of a number of specialist groups, university chairs, a certain degree of social and political legitimacy for science, emergence of professional societies and journals, a system of recognition and a national system of rewards, national identities and prominence in the advancement of knowledge and techniques in a field, specific educational structures for the recreation of the specialist community and network of communication with the evolution of a professional context. These are some of the features which signify the emergence and existence of scientific community in a specific area of research. The introduction to the volume, which attempts to put the country case studies in a true perspective, elaborates the meaning of scientific community at the local, national and global spheres."

"Departing from the basic concept of scientific community, the contributors to this volume address a number of important questions such as: In what ways the colonialism and colonial expansion influenced the institutional structures for modern science; and what is its relationship with the emergence of local - national scientific communities? Where and how does science find its support and legitimation, particularly in the post-colonial and post-war period? Who are the key actors? What role does the ruling political system play? In what ways does the state meditation influence the educational and science and technology structures? Do external factors have a bearing on the content and direction of scientific fields? In what ways do the leading and elite science groups and individuals appropriate the resources and how these influence others? What role does the international connectivity of science play in the national and local context of science? And, why is it that despite sometimes comparable outlays in science amongst countries the results are skewed and vary dramatically? The country case studies in this volume, to my mind, throw ample light on several of these important questions to enable us to draw a comparative scenario?."

While referring to a chapter on India, which presents a historical growth of her scientific community, Dr Mashelkar observed that "some Indian scholars have thus far characterized Indian science as 'fragile', 'sub-Saharan mode' 'peripheral', etc. It is refreshing to note that this chapter draws on newer insights by combining quantitative and qualitative analyses to demonstrate that Indian science is neither 'peripheral' nor it can be clubbed with the 'metropolitan' circles -- it occupies a middle range status. Rather than examining scientific communities through a narrow perspective of citations and publication numbers, this chapter interestingly underlines the notion of 'ecological' impact of scientific communities, which draws attention to those intellectual and professional features that are normally skipped by scholars examining science through only number of publications, citations, etc".

Prof. M.G.K. Menon in his address traced the beginning of modern science and the manner in which the institution of science transformed over the last few centuries, from a curiosity- oriented individual-based activity to what we witnessed as 'big science' in the post-war period. This entailed complex organizations and state-sponsored capital-intensive activity. While referring to the feature of changing structure of science and its 'ethos', Prof. Menon pointed out the way in which values of secrecy and intellectual property rights, among other features, are assuming importance in the institution of science from the last decade. Reflecting on the theme of the volume, Prof. Menon underlined the crucial role of individual actors (such as C.V. Raman, Satyen Bose, M.N. Saha, among others), their commitment, their professional drive and ability to influence the neophytes, their efforts at building the professional research groups and institutional centres and above all their exemplary research 'styles' of operation. Prof. Menon specifically noted that theme and problems of scientific communities in the developing world initiated in this volume deserve a good deal of attention by the scholars.

During the post-war period, particularly from 1970s, countries of the developing world confronted a series of challenges from the oil crises, endogenous developmental processes after the 1979 Vienna conference, new technologies and the present wave of globalization and liberalization. The historical growth of scientific communities and their technological potential as demonstrated by the country case studies in this volume show dramatic variations between different group of countries in Africa, Asia and Latin America. While African countries such as Senegal and Nigeria are still struggling to establish scientific communities at the national level; the Latin American countries over the decade have experienced a relative stagnation in the growth of science budgets which has effected their institutional structures. Rather than pro-active strategies in meeting the global challenges, the Latin American countries have in a large measure resorted to defensive strategies. While the South Asian countries, such as India, are still struggling to convert their scientific potential into marketable technological capacities; the most encouraging results have come from the East Asian countries. There are various learning experiences and strategies discernible from the case studies contained in this volume.

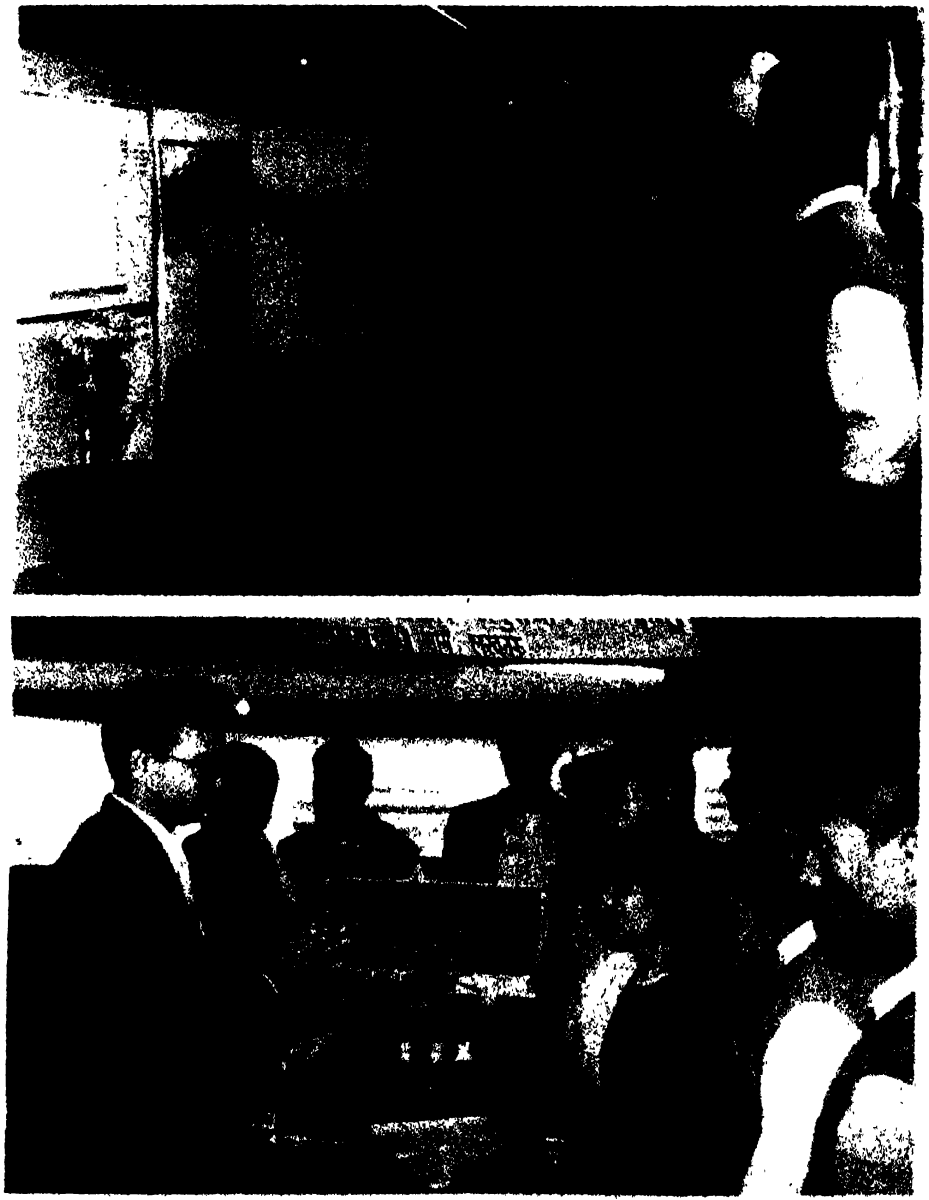
While tracing the changing structure of scientific communities with reference to challenges in the developmental processes, the introductory chapter underlines the importance of a 'new mode' of scientific and technical professionalization within a framework of 'Techno-Economic Networks' involving research communities, industry and the market locales. While questioning the trends of conventional 'input-oriented' science policies in several developing countries, the volume calls for a new perspective of innovation underlining the importance of basing the management of science and scientific communities on the 'entrepreneurial model'. While acknowledging the success stories of East Asian countries, the volume cautions about any glaring generalizations.

In many ways, the volume underlines the importance of the concept of scientific communities and a dynamic mode of professionalization, particularly in the case of several developing countries whose economies are based on agriculture, needing tremendous inputs from the agriculture, chemical and biological sciences. If science and technology have to play a significant role in development then there is no short cut to development other than to promote and constitute specialist research groups and institutions. Even in the present era of globalization, only those countries are likely to draw more benefits which have established a reasonable size of specialist scientific communities and which have created a strong professional climate (a good example is chemical and modern biological sciences in India). Developing scientific and technical capacities through S&T communities has become indispensable in the present era of globalization and liberalization. The conventional forms of technology transfer is not likely to take place in many areas of crucial importance to the economies of the developing countries. Assuming that the *real* partnership in international technology transfer and S&T cooperation is likely to bear fruits with 'equal partners', the signals are clear for developing countries to strengthen and accelerate their professional base in several S&T areas.

The significance of the volume lies in its eclectic approach which particularly combines the sociology of science, social history of science and science and technology policy perspectives. The material contained in this volume should be of considerable importance both to the scholars working in the emerging discipline of STS studies as well as the decision makers in science and technology in the developing countries. ❑

AGRO-Tech'96 at Patna

AGRO-TECH'96 was organized by the Indian Farmers Fertilizer Co- operative Ltd (IFFCO) in collaboration with the Ministry of Agriculture, Government of India and the Bihar Government. This 10-day exhibition was inaugurated by the Governor of Bihar Dr



CRRI and ITRC technologies being explained to the visitors at AGRO TECH'96

A.R. Kidwai and the Union Agriculture Minister Shri Chaturanan Mishra, on 18 December 1996. The aim of the exhibition was to promote the modern food and agriculture-based industries, post-harvest and other related technologies for improving the quality of life of rural and suburban masses. About 200 participants representing government S&T organizations/agencies, private industrial units, etc. took part in the exhibition. An estimated 5 to 6 lakh visitors from different parts of Bihar (Patna, Bhagalpur, Muzaffarpur, Samastipur, Nalanda, Motihari, Ara, Gaya, Vaishali, Begusarai and others), U.P. (Gorakhpur and Gajipur), Punjab and also Nepal visited the 209 stalls put up at the exhibition. Many farmers/cultivators and other vistors also participated in different conferences, seminars, symposia and training & cultural programmes organized during the exhibition.

From CSIR, the Polytechnology Transfer Centre, Patna and several laboratories including Industrial Toxicology Research Centre (ITRC), Lucknow; Central Food Technological Research Institute (CFTRI), Mysore; Central Road Research Institute (CRRI), New Delhi,; Central Building Research Institute (CBRI), Roorkee; and National Geophysical Research Institute (NGRI), Hyderabad, participated.

From ITRC, Dr Sheo Kumar, Shri Kanhiya Lal and Shri Zahid Hussain gave demonstration of Amrit Kumbh -- a low-cost device for purification of raw drinking water, water analysis kit for estimation of undesirable chemicals and bacteriological contaminants in raw drinking water, mobile water testing laboratory for analysis of drinking water quality in rural areas, and colour detection (CD) strip for the estimation of impurities/adultrants in mustard oil.

The main emphasis of the display of CRRI was on rural roads. CRRI's expertise in the use of low-grade materials, planning and design of rural road network, utilization of industrial and agricultural wastes like fly ash, coal ash, blast furnace slag, municipal wastes, etc. in road construction and many more areas of highway engineering, was displayed. The techniques developed by the institute are environment-friendly as well as low-cost.

The CRRI stall attracted a large number of visitors. Farmers and rural people took keen interest in the display pertaining to rural road network planning. By constructing small road lengths, a large number of villages can be connected through rural road network. CRRI also demonstrated the design of the durable roads for the flood-prone areas which may be very useful for the states like Bihar and Andhra Pradesh.

NGRI explained the role of 'Earth science' in rural development through various exhibits dealing with groundwater exploration, exploitation and management, different methodologies used for exploration of mineral and energy resources along with its work on fundamental studies of processes related to Earth system.

Shri Chaturanan Mishra, Union Minister for Agriculture and, Shri D.P. Yadav, IFFCO President, were among the prominent visitors to the CSIR stalls. The IFFCO President desired the formulation and execution of a project on groundwater exploration and pollution studies with remedial measures in different districts of Bihar. About 10,000 visitors to the ITRC stall expressed their interest in buying Amrit Kumbh and CD strips. Appreciation certificates were given to participating laboratories (e.g. CRRI) and scientists (e.g. Dr Sheo Kumar) at the closing ceremony on 28 December. ❑

PETROTECH-97

THE National Geophysical Research Institute, (NGRI), Hyderabad, participated in the 'PETROTECH-97' held at New Delhi from 9 to 12 January, 1997. The objective was to highlight the expertise and capabilities of the institute in the field of hydrocarbon exploration. Major international and Indian companies/organizations associated with various upstream and downstream activities in the petroleum industry participated in the exhibition. Many dignitaries visited the institute's stall and appreciated the institute's endeavours in the area of Hydrocarbon Exploration. Three leaflets on: Magnetotellurics, Controlled Source Seismicity and Gas Hydrates, brought out on this occasion, were provided to the visitors.

Shri T.R. Baalu, Minister of State for Petroleum and Gas, Government of India, also visited the NGRI stall. He was apprised of the expertise of NGRI in the field of hydrocarbon exploration, particularly the programme 'Integrated Geophysical Surveys for Hydrocarbon Exploration' that NGRI has taken up in Trap-covered areas of Saurashtra, under the sponsorship of ONGC.

Shri T.R. Baalu, Minister of State for Petroleum and Natural Gas, and Shri B.C. Bora, Chairman-cum-Managing Director, ONGC, at the NGRI stall at PETROTECH-97

Shri B.C. Bora, Chairman-cum-Managing Director, ONGC, while visiting the NGRI display, showed keen interest in the Gas Hydrate Exploration work carried out by the institute. He was also provided the latest results obtained by the multiparameter surveys carried out in Saurashtra Region. Shri C. Ratnam, Former Chairman, Oil India Ltd. also visited the NGRI stall. Lauding the capabilities of NGRI in the field of hydrocarbon exploration, he suggested that the institute's exploration activities could be extended to other regions as well.

The exhibition provided a good avenue to discuss and interact with various other organizations, and project NGRI's expertise in the field of hydrocarbon exploration. ❑

Letter from Antarctica

SHRI M.P. Ramesh, Head, Wind Energy Programme, National Aerospace Laboratories (NAL), Bangalore, is currently touring with the India Expedition to Antarctica. He has recently written about his experiences from *Maitri*, Priyadarshini Lake, Antarctica. His letter, which came by e-mail, says:

"It has been nearly a fortnight since I came over and I am still to get a grip of things. It was a long trip from India and the experience was much better than what my doomsday-predicting friend had warned. Most of the time there isn't much to do aboard the ship - so we play around with smart notebook computers, watch an endless numbers of videos and eat so much food that it makes you sick. The ship travelled at a speed of about 14 knots most of the time and we eventually reached 69 degrees and some minutes on 6 January 1997. After this the ship could not get across what they call pack ice. Pack ice is fresh ice, no thicker than a few metres and unless you have a special ship you just sit back and hope that the ice will break. Fortunately, it was just nine nautical miles from shelf ice. So helicopters started flying personnel, scientific equipment and food to our station called *Maitri*. It is about 150 km from the ice shelf. The station, located at 70 S 14 E, is situatated on the bank of a zub lake (now named Priyadarshini lake) and is surrounded by the Sehirmacher Hill Range. These hills are not too high. Some portions of the hill and lake are still covered with last year's snow. The hills are surrounded by shelf ice on the north and continental ice in the south (about 1 km behind our station).

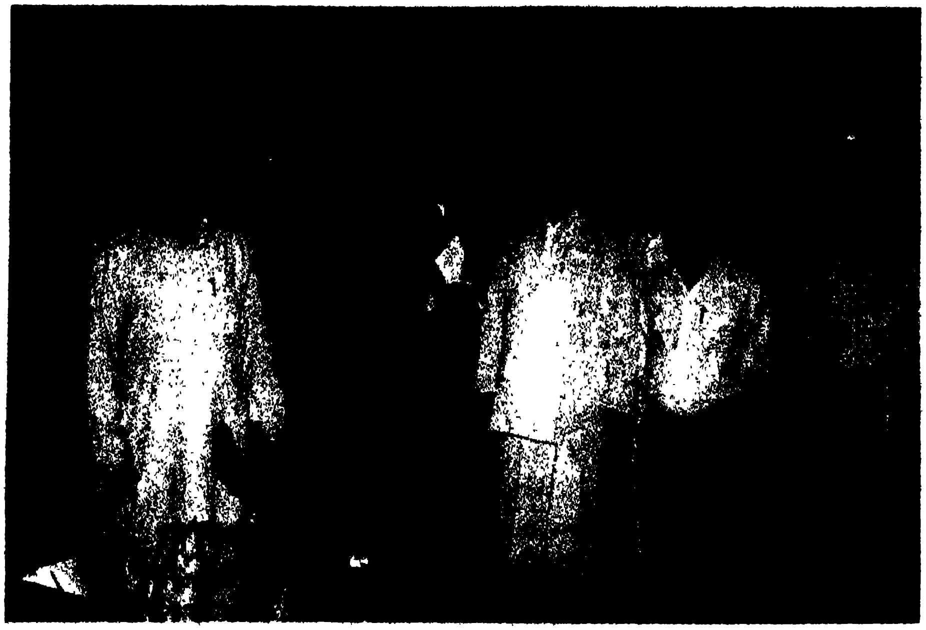
A watch is one of your most prized possessions here because in summer (remember that it is summer time now in the Southern hemisphere!) it never gets dark. I am told that night occurs briefly starting from the end of February. Let us wait and see. Working outside is really tough on windy days although temperatures have been quite high (4 degrees), and we have been having many good sunny days. The general method adopted in our expeditions is that every year a team leaves India (in December) and reaches here by January. There is a summer team and winter team. Summer team returns to India by April. Each person in the team has a well-defined assignment and generally a lot of work gets done.

I have more or less completed the first part of the work. In my spare time I get to go about the hills and into continental ice. It is an experience of a lifetime! Once you get on top of continental ice it is white all around and at places there is blue ice on which it could be quite dangerous to walk. Normally one uses track vehicles to get around here. Small aircraft such as the Hercules land quite close to our own station (10 km into the continental ice) The so called 'airstrip' is manned by Russians. There is an organization called Polar Logistics which takes adventure tourists around Antarctica and also provides certain courier services. Flight from Cape Town to these parts takes about 9 hours. By ship it is a 7-10 day trip. There are also trips from Chile to the South Pole and back but, as you can guess, at a steep price." ❑

Parliamentary Standing Committee on S&T at NAL

THE Department-Related Parliamentary Standing Committee on Science & Technology, Environment and Forests visited the National Aerospace Laboratories (NAL), Bangalore, on 11 February 1997. The visit was a part of a series of visits to CSIR establishment being undertaken by the Committee. Members of the Committee who visited NAL are: Shri V Narayanasamy (Chairman), Justice Guman Mal Lodha, Dr Ramakrishna Kusmaria, Shri Mahabirlal Bishwakarma, Prof.Radhika Ranjan Pramanik, Shri Jitendranath Das, Shri P. V. Rajendiran, Shri N. K. Premachandran, Dr Mahesh Chandra Sharma, Dr Y Radhakrishna Murthy and Shri G Swaminathan.

The Committee was received by Dr T.S. Prahlad, Director, NAL. The introductory meeting featured a detailed presentation by Dr Prahlad on NAL activities with special reference to NAL's *SARAS* programme. This was followed by a whirlwind tour of the two NAL campuses and C-MMACS, in the course of which the Committee saw the LCRA and the two *HANSA* aircraft, the *SARAS* mock-up, the 1.2 x 1.2 m^2 trisonic wind tunnel and two technology



NAL Director Dr T.S. Prahlad showing a wind tunnel model to Shri V. Narayanasamy, Chairman, and members of the Parliamentary S&T Committee displays arranged at NTAF and Composite Structures Laboratory.

One of the highlights of the visit was the concluding session where the Committee members were given answers to their questions on NAL's R&D plans, technologies and strategies. ❑

TRAINING PROGRAMMES

Mass Spectroscopy

AN international training course on Mass Spectrometry was conducted at the Indian Institute of Chemical Technology (IICT), Hyderabad, for two weeks from 20 January 1997. The course was formally inaugurated by Prof. Goverdhan Mehta, Vice-Chancellor, University of Hyderabad. A total of eight participants from Egypt, Saudi Arabia, Sri Lanka, Thailand and Turkey attended this course.

The course comprised 26 lectures, covering fundamental aspects of mass spectrometry; various ionization techniques such as electron ionization (EI), chemical ionization (CI), fast atom bombardment (FAB), matrix-assisted laser desorption (MALDI), electrospray ionization, thermal ionization and inductively coupled plasma ionization; gas chromatography-mass spectrometry (GC-MS); liquid chromtography-mass spectrometry (LC-MS); mass spectrometry-mass spectrometry (MS-MS) and various applications of mass spectrometry, delivered by experts in the respective areas. Demonstration was given in EI, CI, high resolution, LSIMS, GC/MS, source cleaning and refurbishment of filaments. The progress of the course was monitored by Dr K.V. Raghavan, Director, IICT.

Prof. D. Balasubramanian, Director, Centre for Cellular and Molecular Biology, Hyderabad, was the Chief Guest at the veledictory function, and distributed certificates to the participants. ❑

DEPUTATION ABROAD

Dr Santu Bandyopadhyay

DR Santu Bandyopadhyay, Scientist, Indian Institute of Chemical Biology, Calcutta, was deputed by the Department of Biotechnology to the Indo-US Vaccine Action Programme meeting held at National Institute of Health, Bethesda, Maryland. He presented his work on host-parasite interactions at the meeting. ❑

HONOURS & AWARDS

Dr J.S. Sandhu

DR Jagir Singh Sandhu, Deputy Director and Head, Drugs and Pharmaceutical Chemistry Division, Regional Research Laboratory (RRL), Jorhat, has recently been elected a fellow of the Indian National Science Academy (INSA), New Delhi.

A senior scientist with more than 31 years of professional experience in research and management, Dr Sandhu's research interest is mainly in the area of synthetic organic chemistry with special reference to biomolecules; organometallics, phase transfer catalysis and microwave-induced solid state reactions. His work has the distinction of having considerable originality and wider importance in organic and bio-organic chemistry. He joined RRL-Jorhat in 1976. Prior to this, he worked as the R&D Manager at M/s Ranbaxy Labs Ltd, New Delhi, where he established a modern R&D laboratory. His endeavour has led to the commercialization of five drugs in the area of CNS-acting agents, analgesics and antibiotics. He was awarded Ranbaxy Prize for his outstanding R&D achievements.

Dr Sandhu has published more than 150 original research papers in international journals, two books, two reviews. He has one international patent to his credit. He is a recognized guide for the Assam and Punjab Universities, and 15 students have completed their Ph.D. theses under his guidance.

Dr V.R.K. Rao

DR V. Rama Krishna Rao, Emeritus Scientist, National Metallurgical Laboratory (NML), Jamshedpur, has been chosen as an Editorial Board member of *Problemy Spetsal' noi Electrometallurgy* of Patan Institute, Kiev, Ukraine. ❑

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012.
Printed at NISCOM Printing Unit

Annual Subscription : Rs. 60
Editor : Dr B.C. Kashyap   Editorial Assistant : Neelima Handoo   Production : Kaushal Kishore   Single Copy : Rs. 3.00
Phone : 5786301   Gram : PUBLIFORM   Telex : 031-77271   E-mail: niscom@sirnetd.ernet.in.   Fax : 5787062

ISSN 0409-7467

CSIR NEWS

NAL-GTRE MoU on *Kaveri* Engine Project

THE National Aerospace Laboratories (NAL), Bangalore and Gas Turbine Research Establishment (GTRE) signed a memorandum of understanding at GTRE on 19 March 1997. The MoU states: "After a mutual study of technical problems faced at GTRE (related to the *Kaveri* engine) NAL agrees to submit time-bound proposals that may involve engineering analysis and results; conducting specific experiments in NAL facilities and providing results, fabrication of tools and equipment; generation of validated software packages and conducting exploratory studies and setting up of facilities." The areas identified for collaboration by the MoU consist of a basket of ten problem areas including afterburner studies, compressor inlet distortion effects, combustor design and analysis, vibration measurements of compressor blades and others.

The MoU was signed by Shri V. Sundara Rajan, Director, GTRE and Dr T.S. Prahlad, Director, NAL, in the presence of their senior colleagues. It was a pleasant ceremony in GTRE's imposing Conference Hall. After exchanging the MoU documents with his GTRE counterpart, Dr Prahlad remarked that the "best MoU is one which we never have to refer to again". Shri Sundara Rajan heartily endorsed this sentiment. Another significant collaboration in aerospace science and technology thus began on just the right note. ❑

IICT-KSCCF Agreement for Revival of Activated Carbon Plant

THE Indian Institute of Chemical Technology (IICT), Hyderabad, has signed an agreement with M/s Karnataka State Coir Cooperative Federation Ltd (KSCCF), Bangalore, for revival of their activated carbon plant at Arisekere. Under the agreement, IICT will provide engineering package with turnkey services to KSCCF to manufacture two tonnes/day activated carbon from coconutshell char, and also the coir pith char briquettes. Coir pith briquettes produced from the plant are a cheap source of fuel. The production of the briquettes would solve coir path disposal problem and help in rural employment generation.

The project is proposed to be implemented in four phases over a period of 30 months. The plant is expected to start manufacturing coir pith briquettes in phase-I, coconut-shell char in phase-II, and activated carbon from pith char and coconut-shell char in phases-III & IV. The sales turnover of the plant is estimated to be around Rs 35 million per annum at full capacity. ❑

NATIONAL GEOPHYSICAL RESEARCH INSTITUTE, HYDERABAD
R&D Highlights 1995-96

THE National Geophysical Research Institute (NGRI), Hyderabad's R&D programmes are grouped under the following major areas: Seismology; Lithosphere, Earth's Interior and Environment; Groundwater; Geophysical Explorations; and Geophysical Instrumentation. In addition, the institute has Special Activity Groups concerned with geomagnetic observatories, geoscientific investigations in Antarctica, computer and training.

NGRI's collaborative efforts with industry have been particularly gratifying in the areas looking for possible locales of hydrocarbon occurrences in Mesozoic sediments. Sponsored by the Oil and Natural Gas Corporation (ONGC), the institute's work to provide 3-D maps of thickness of Mesozoic sediments below the basaltic lava flows in the entire Saurashtra region measuring some 80,000 sq km has been on schedule. The work carried out in Saurashtra involves measurement of various physical parameters involving seismic, magnetotelluric, gravity and deep electrical sounding approaches. The four sets of data have been inverted and consistency of results examined. The work is being carried out under extremely difficult field conditions, involving over 200 scientists and technicians. This work is expected to provide suitable locations to ONGC, for drilling, and if oil is discovered, it would make an impact on the whopping annual oil import bill of nearly 270,000 million.

A reassuring result has been obtained from the deep drilling in Latur. The drill data establish that the Deccan Trap (DT) lies directly above the basement with only 8m of sediments, and its thickness is ~338m. This is remarkably close to a thickness of 350m inferred earlier from the surface Magnetotelluric (MT) observations. These consistent results have firmly established the suitability and efficacy of MT method to map the Deccan Trap covered terrain which lies over a vast region in the central and western parts of our country.

Performace Indicators: 1995-96

Sponsored/Grant-in-aid Projects	: 53
Research Papers - (i) Published	: 117
(ii) Presented in seminars/symposia	: 116
Technical Reports	: 19
Books	: 1
Budget	: Rs 111.028 million
External Cash Flow	: Rs 49.800 million

Encouraged by the success of the NGRI's MT investigations, the Directorate General of Hydrocarbons (DGH) has sponsored a major programme for delineating the subtrappean sediments in the Nagpur-Wardha area. Four profiles around Katul (west of Nagpur) have been completed, which indicate presence of thick sediments below the basaltic cover.

Towards locating new energy reservoirs, NGRI is working on a Gas Authority of India Limited (GAIL)-sponsored programme to explore if 'gas hydrates' exist within our country's Exclusive Economic Zone.

A systematic geochemical exploration has been taken up under a Department of Science and Technology (DST)-sponsored and industry-oriented project that aims to discover economically exploitable gold deposits. Significance of this work is evident from the observation that indigenous demand of the yellow metal exceeds 500 tonnes/annum and the production is only about 2 tonnes/annum. From the geochemical mapping, using 600 samples from the Sandur and Chitradurg schist belts of Karnataka, gold values of 0.7 to 8.0 g/tonne have been established for Kunchiganalu and C.S. Halli areas. Locations for test drilling and open cast mining, have been identified and recommended. It may be mentioned that for open cast mining, reserves of above 0.6 g/tonne of gold are exploitable economically.

As a result of NGRI'S studies on seismicity over the subcontinent, certain active faults have been better constrained now. These are the Kopili in the North-east; and Koyna-Chandel and Bhogiv faults near Western Ghats. The latter is surmised to possess potential for an $M>6$ earthquake and thus requires more careful monitoring and imaging.

In Latur earthquake region, deep drilling up to 670m has been completed to study the geo-mechanics of the causative faults and the nature and disposition of the host geological formations.

For the ever increasing requirement of water for drinking and irrigation, NGRI's expertise has been sought to locate potential sites for 2000 wells in the dry and hard rock areas of the northern Karnataka. Nearly 432 sites have been identified and 141 of them drilled. Sixty-eight of these are giving an yield of more than 1000 gph while in 6 wells the yield has exceeded 6000 gph. This is a very good yield, particularly for a hard rock terrain.

In order to ascertain the water leakage in the bunds of the Nagarjunasagar right canal, geophysical engineering investigations have been carried out and certain weak zones identified. And in connection with finding intact rocks, free of fractures, work on geophysical bore well-logging has been completed at the Kalpakkam Atomic Power Station. Similarly, for the proposed Basohli bridge in the Jammu and Kashmir, the necessary geological and geophysical data have been analyzed to estimate earthquake hazard.

In addition to these, some of the other important results obtained during 1995-96 are :

Basic Knowledge Based

Controlled Source Seismology (CSS): The deep reflection profile and refraction studies in Central India have provided deep crustal structure in terms of velocity and reflecting surfaces. On collation with gravity and MT signatures the distinction in the crustal column beneath a craton (Bhandara-Bastar) and a mobile arm (Satpura) has been brought out for the first time.

Gravity and Magnetic Anomalies : The results from long wavelength magnetic and gravity anomalies in conjuction with other geological, tectonic and geomorphological data suggest that Sri Lanka was not detached from India during the Gondwana break-up. Similarly, gravity signatures along the E-W trending Narmada-Tapti lineament in conjunction with CSS-deduced velocity structure bring out magmatic underplating, probabaly associated with the Deccan volcanism.

Aeromagnetic Anomalies : Quantitative analysis of the aeromagnetic anomaly map over Narmada-Son belt reveals a ENE trending deep causative source south of Gadarwada, whose margins are delineated by using the horizontal gradients method. Modelling results of magnetic anomaly over carbonatite complex in Shillong suggest that this part of India was at approximately 45°S during late Jurassic.

Paleomagnetism: Magnetization study at four sites near Killari corresponds to the magnetic reversal (R) index of 29R which is in agreement with the Normal-Reverse-Normal (N-R-N) magnetostratigraphy sequence at the Cretaceous-Tertiary Boundary (KT-B), i.e. 65 Ma. For the first time, the simulated annealing (SA) strategy of global optimization procedure has been deployed to interpret the geomagnetic depth sounding data.

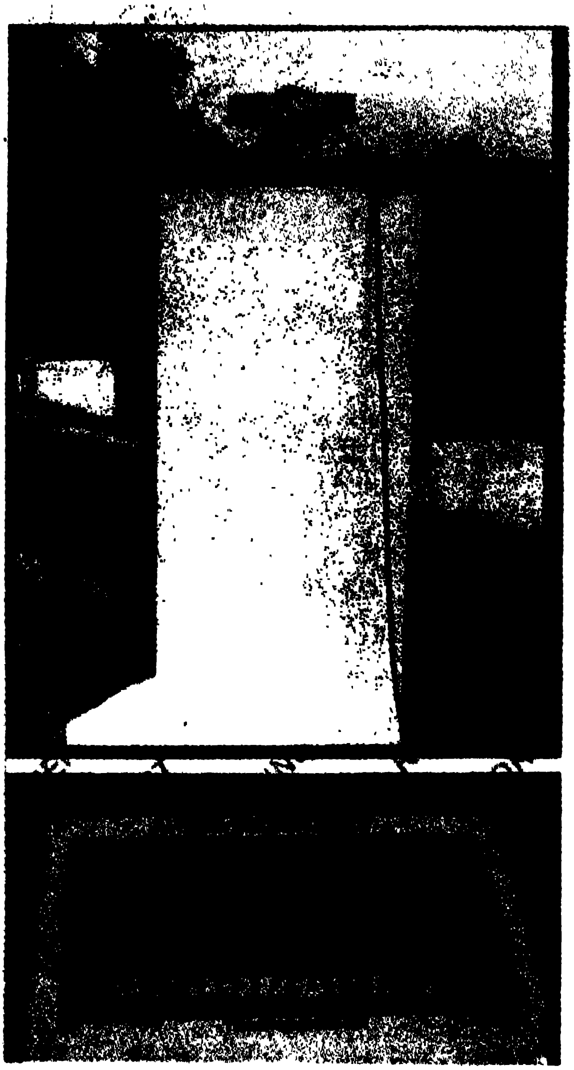
Helium and Heatflow: Thirty-six temperature measurements have been made in 150-200m boreholes in Pune-Ahmadnagar, Wardha-Yavatond and Killari regions. With this, good coverage of heatflow (q) has been established over the Deccan Volcanic Province. The heatflow value varies between 35-50 mW/m^2, equivalent to that of Archean Peninsular gneisses, indicating low-heat flow generation.

Geochemistry: A conceptual model has been proposed for the genesis of gold deposits in Banded Iron Formation of greenstone belts. The geochemical analysis of the Eastern Ghats Granulite Belt (EGGB) shows two cycles of peltic sedimentation protolilth. The P-T estimates for (i) Machkand charnokites are 610±30°C and 6.0°0.5 kb, and (ii) Gamparian region are 7.9±0.5 kb and 860±20°C at a burial depth of 25 km. The time of emplacement of granitoid in Paderu area has been found to be 1890±21 Ma with initial ^{87}Sr/^{86}Sr ratio of 0.7172±9, the latter suggestive of crustal source, Nagavalli-Vamsadhara shear zone has been identified by means of landsat data.

Around Salem in Tamil Nadu, the geochemical analyses of granulite facies of Banded Iron Formation (BIF) suggest a marine depositional environment under reducing conditions. Imprints of the Meso-proterozoic alkalimetasomatism of Aravalli supracrustals due to Delhi orogeny have been recognized from the age (1399±26 Ma), and Sr$_i$ value of 0.7515±6 has been obtained from the paleosols at the interface between the BGC and Aravalli supergroup.

Geochronology: Two episodes have been inferred from the Sittampundi anorthosite complex in the Cauvery shear zone, which correspond to Sm-Nd and Rb-Sr isochron ages of 2.75 Ga and Rb-Sr mineral isochron age of about 700 Ma, respectively. The carbon isotopic composition of CO_2- rich fluid inclusions from Salem Dharampuri region indicates a juvenile source, and hence, involvement of mantle CO_2 related to carbonatite magmatism at 2400 Ma. The Delwara protovolcanics of the Paleo-proterozoic Aravalli super group gives Rb-Sr age of 1397±53 Ma and Sr_i of 0.7148±4.

Rocks under High Pressure and Temperature (HPT): From the study of rocks under high pressure and temperature conditions, green garnets from Badrihalli region in Karnataka have been found to be of metamorphic origin. X-ray defraction studies of graphites from Kolar and Sargur rocks indicate their peak metamorphic temperatures as ~530°C and 600-650°C, respectively.



GPS antenna mounted on a choke ring over a pillar on top of NGRI Extention Building, and 8-channel Turb Rouge SNR 8000 GPS geodetic receiver

Marine Geophysics: While reconstructing the subsidence history of the eastern and western margins of Peninsular India, model computations were carried out based on the backstripping method. These have been brought out a zone of 150 km stretching beneath the eastern margin. On the western margin, the thermal subsidence has been found to be ~5.3 km over a period of ~65 m.y. Multichannel seismic reflection data around Mangalore have been used to estimate the extension. These show significantly varying stretching factors along western margin. The magnetic and gravity data analyzed in collaboration with the Geological Survey of India show slow spreading across the Carlsberg ridge.

Groundwater: The radio carbon dating lab facilities have been established at the institute and, for the first time, isotopic signatures of last glacial period (18±2K yr BP) have been recorded in the confined groundwaters of South India.

The analysis of the integrated geological, tectonic and geophysical data over the eastern and southernmost part of peninsular Indian shield suggest that the Marion plume might have substantially affected the shield region and hence, the Palghat- Cauvery transition (PC-T), a belt of major topographic low probably represents an aborted breakup of the subcontinent during the Cretaceous times.

Thermomechanical modelling of Indian Lithosphere is essential for quantification as well as physical insights. Models have been developed for: (a) temperature evolution in connection with gold mineralization, (b) estimating the mean basal heatflow for sedimentary basin and (c) the space-time behaviour of water table in an island aquifer.

In connection with the nonlinear geophysical processing, an algorithm has been developed which uses all the mix reading half- addition permutation group. Significant progress has been achieved on signal design for development of nonlocal optimization strategies.

With regard to the Geodetic Very Long Base Interferometry (VLBI), a permanent Geoposition Satellite (GPS) tracking station has been established at NGRI. Continuous GPS measurements are being made round the clock.

Antarctica: Two lamprophyre dykes from eastern Antarctica have been found to be dated isotopically (Rb-Sr) at ~460 Ma, giving low Sr value of 0.7084. These may be associated with alkaline magmatism during the Ross orogeny of the Trans-Antarctica mountain.

Economic Growth Based

Controlled Source Seismology: In second phase of the sponsored Integrated Geophysical Programme in Saurashtra, the targeted 800 line km of reflection/wide angle refraction data have been acquired. These data sets are under different stages of processing, using new innovative techniques of signal extraction.

Gravity and Magnetic: Fifty-five hundred high resolution gravity stations have been established under an ONGC-sponsored programme. Processing of ~3000 station data on the Western part of the Saurashtra Peninsula has been completed.

Aeromagnetic: Power spectral approach for the aeromagnetic data over the Eastern Dharwar craton brings out alternate up and downwarpings of the inter-crustal magnetic interfaces. The domal upwarps seem to be linked with occurrence of Kimberlite diatremes (e.g. Wajrakarur and Chingicherla).

Subsurface Conductivity Imaging: From the forward induction modelling of a laterally heterogeneous situation as in Saurashtra, it has been shown that a low resistivity could be inferred even over a highly resistive ground. Hence, appropriate correction is needed while interpreting MT or equivalent data.

Exploration Geophysics : A hitherto unarticulated mathematical formulation has been outlined to estimate the appropriate impedance logs. Fourier finite difference migration scheme has been worked out for transversely isotropic medium.

Fractal Crustal Magnetization : Analysis of the susceptibility data up to 4 km depth from the German deep hole (KTB) indicated a 'scaling of fractal' pattern. Scaling property of the source and noise has been deduced from the power spectra of gravity/magnetic fields. This has resulted in modification of the conventional power spectral method (PSM), giving different basement estimates.

Geostatistics : Maximum entropy method (MEM) and Markovian models for the stochastic characterization in Zone-1 reef of Hutti gold field have indicated periodicities in mineralization pattern.

Geophysical Instrumentation: Work on the deep resistivity meter, bore hole logger, and magnetic gradiometer is at different developmental stages.

Human Welfare Based

Seismology: State-of-the-art digital technology has been introduced for the seismic and *in-situ* pore pressure monitoring at Koyna. An earthquake catalogue and a seismic hazard map have been prepared for the Global Seismic Hazard Assessment Programme (GSHAP) Test Area 8, covering Eastern Himalaya, Northeast region of India, Myanamar and adjoining China and Southeast Asia. Deformation tectonics of different Indo-Australlian boundary has been analyzed using the centroid moment tensor data.

Helium and Heatflow : The helium expression over the Latur earthquake rupture are still persisting. Measurement of 3He/4He ratio indicates mainly a radioactive origin.

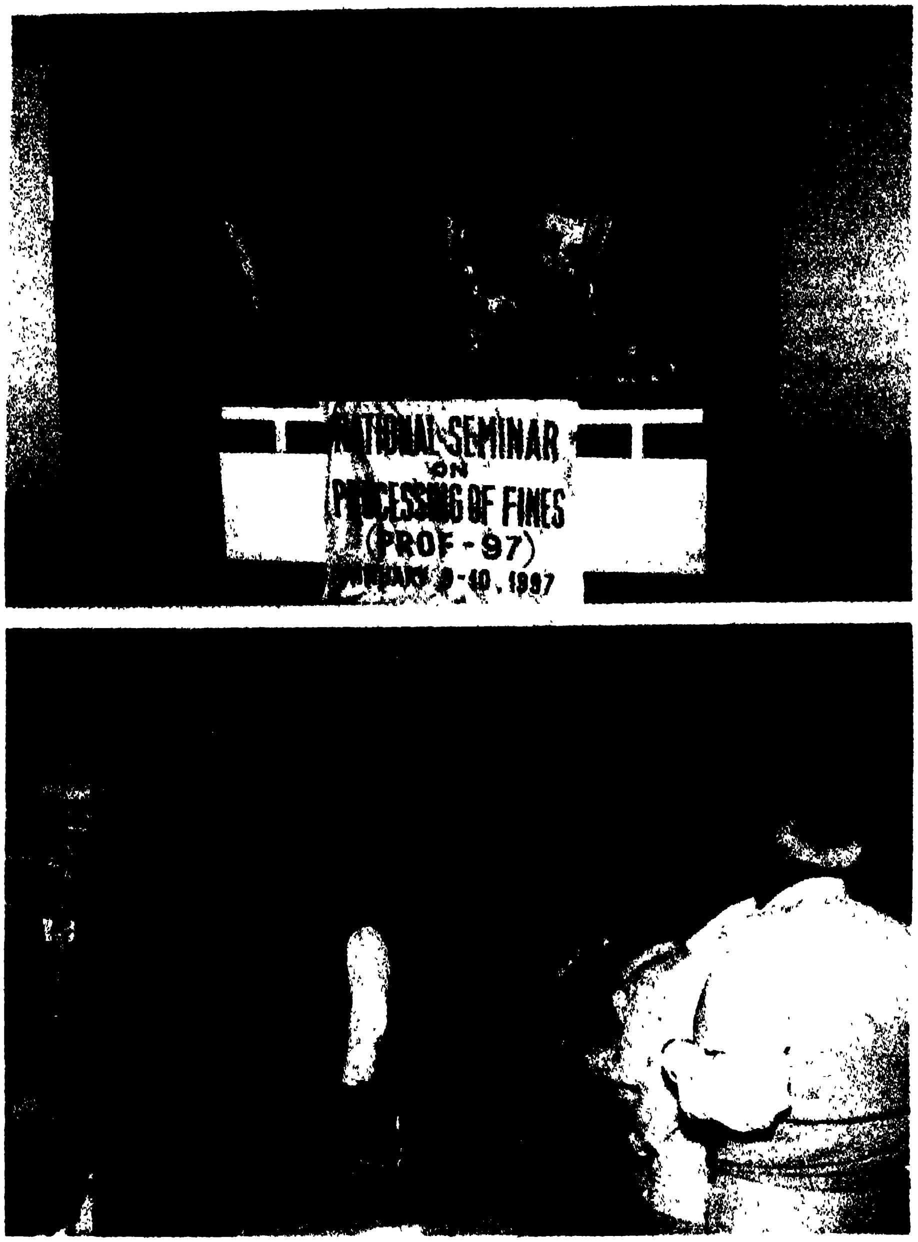
In-situ stress field is being measured to comprehend the nature, state and possible mechanical response of the Indian subcontinent. A maximum horizontal compressive stress (S_{Hmax}) map has been prepared for the northeast region of India. It is deduced that Shillong, North Bengal basin and Kopili lineament account for 87% of the seismicity in Northeast India, while Upper Assam and Rajmahal regions together account for only 6%.

Groundwater: Short duration artificial recharge experiments conducted at one of the sites in a flouride affected district have shown quality improvement and augmentation. Three stages of delta formations have been identified and boundaries of associated fresh water resources delineated. ☐

SEMINARS

National Seminar on Processing of Fines

PROCESSING of fines has always posed a daunting challenge to mineral engineering. Presently, the problem has aggravated considerably due to increase in complexity of the ores and emphasis on mechanized mining. These fines do not respond well to the conventional beneficiation techniques, causing high losses of values, besides environmental pollution. Keeping this in view, the National Metallurgical Laboratory (NML), Jamshedpur, jointly with the Indian Institute of Mineral Engieers, organized a national seminar on 'Processing of Fines' (PROF-97) during 9-10 January 1997. It was attended by more than 60 delegates from academia, R&D organizations and industries. To name a few — National Mineral Development Corporation Ltd, GMDC Science and Research Centre, ESSAR Steel Ltd, Indian Rare Earths Ltd, Metallurgical Engineering Consultants (In-



Dr R.N. Sharma, Adviser to MD, TISCO, releasing the souvenir during the inaugural session of National Seminar on Processing of Fines at NML, and participants of the seminar visiting the mineral processing facilities at NML

dia) Ltd, Septu (India) Pvt. Ltd, Promac Engineering Industries Ltd, Allen-Bradely India Ltd, Saurashtra Calcine Bauxite Allied India, TISCO, SAIL, IIT (Kanpur), ISM (Dhanbad), Andhra University, Gulbarga University, ORIND, Rishabh Metals & Chemicals Pvt. Ltd and CSIR laboratories working in relevant field (NCL, Pune; CMRI; RRL, Bhubaneswar and RRL, Bhopal).

Prof. P. Ramachandra Rao, Director, NML and Chairman, PROF-97, welcomed the guests and the participants to the seminar. While introducing the central theme, he said, "Processing of fines was specially chosen in view of the increasing complexities in the mineral industry owing to the problem of fines generated during mining and processing of minerals. On one hand, the fines constitute an enormous loss of scared national resources, on the other, they cause severe degradation of the environment. Added to this is very different physico-chemical characteristics as compared to that of the coarser particulate matter, which makes their effective processing a formidable challenge to Science and Technology".

Dr R.N. Sharma, former Chairman-cum-Managing Director, Coal India Limited and Managing Director, The Tinplate Company of India and presently, Adviser to Managing Director, TISCO Limited, in his speech as Chief Guest spoke on 'Processing of Fines' as applicable specially to the coal sector. He emphasized the need for tailor-made plant layout and selection of operating parameters for treatment of each coal type, and suggested for computer-aided testing of a large number of alternatives for selecting the optimum one. Minimizing errors in handling of equipment through automation of plant operation was another point emphasized by him to limit the wastage through losses of fines. He also laid special stress on the necessity of a close liaison between industry and R&D institutes, and on the development of specially designed indigenous equipment suitable for Indian ores and minerals.

Dr Sharma also released a colourful souvenir brought out on the occasion. Dr P.K. Bhattacharyya, Convener of PROF-97, proposed a vote of thanks.

The technical session that followed had the presentation of 18 research papers. After this, a special session was held wherein 14 poster presentation-cum-demonstration of the various bench and large-scale experimental facilities of Mineral Processing Division of NML were displayed. The session witnessed a close interaction among the participants. Topics covered include different aspects of characterization and communition; gravity and magnetic separation; beneficiation of metallic and non-metallic ores; beneficiation of coal and graphite; modelling, simulation and agglomeration and treatment of waste materials and minerals. A few review papers were also included.

The concluding session was chaired by Prof. S.P. Mehrotra of the Deparment of Materials and Metallurgical Engineering, Indian Institute of Technology, Kanpur. The Chairmen of the different technical sessions participated in it and offered their suggestions. The necessity to evolve a national policy with adequate legislation to control the production, storage, processing and utilization of mineral fines, and to develop a centre of excellence in the focussed R&D areas were felt and recommended.

The proceedings volume (hard bound) can be obtained from the Director, NML, Jamshedpur 831 007, by sending a Demand Draft for Rs 1000 payable to 'Director, NML Jamshedpur' at SBI, NML Branch (Code 3329), Jamshedpur. ❑

All India Seminar on 'Quality and Motivation in Administration in CSIR'

THE above seminar was organized by the Indian Institute of Chemical Technology (IICT) and the Centre for Cellular and Molecular Biology (CCMB), Hyderabad, on 3-4 January 1997. Dr G.S. Sidhu, former Director General of CSIR, was the Chief Guest, and Prof. D. Balasubramanian, Director, CCMB, presided over the inaugural function.

Dr R.A. Mashelkar, Director General, CSIR, who could not attend the seminar, sent his message in which he appreciated the holding of the seminar, which was the first of its kind. This, he said, is a sure indication of the Administration's determination to offer purposeful support to R&D. He emphasized that the role of administration in traversing the road to *CSIR Vision 2001* is undoubtedly very crucial. Since it has to facilitate the scientists' working, enabling the creation and sustenance of a congenial environ for high-class R&D, and above all, inculcating among the staff of various cadres, a sense of mutual dependence. Dr Mashelkar also brought out the need for ushering in a spirit of administration by objectives, dispensing with the tendency to be rule protected. He hoped that the CSIR Administration would be a role model with a disposition to be averse to delays, alert to differences and sensitive to discrimination in all aspects of its functioning.

Prof. D Balasubramanian in his address stressed the need to realize that an individual's role is to attain the goal while working with ideas in a group. The idea of symposium, he said, reflects togetherness, as the 'Sym' in 'Symposium' means 'together'.

The Chief Guest Dr G.S. Sidhu underlined the need for an Administrator to infuse in his habit of work the element of close rapport with the staff, so that he remains in touch with the various aspects and achieves better results. He said that it is essential for the Head of the laboratory and the Controller of Administration to be clear about their respective roles in administrative matters, viz. the role of setting objectives and providing appropriate backing (role for Head of the Laboratory) and fulfilling the results with the objecives of the Administration (role of the Controller of Administration). He also said that positive attitude of Administrator is essential and should be given a high priority. Negative response to the requests of staff can be minimized by a policy of requiring approval from higher authority. He opined that delay or avoidance of a task is much harmful, because we can never make good the loss of time while we can always rectify any wrong in a task undertaken in time.

Smt. Chandrika Raghavan lit the inaugural lamp.

This was followed by a keynote address on 'Quality in Administration' by Prof. D. Balasubramanian, in which he emphasized the need for adopting the attitude: "I can do", for achieving better quality output in CSIR Administration. He said that Administration should not tend to be an impersonal apparatus, and rules & regulations should be in consonance with the present developments. He opined that Directors should be involved in the system of common cadre postings and transfers.

Thereafter, the session on 'Quality in Administration' commenced with an invited lecture by Shri Harinath of the Kalwa Institute of NDT & Quality Management, Hyderabad, covering awareness of total quality management and its relevance to Administration in scientific organizations, and a brief background of ISO 9001, etc. Shri S.P. Kaushika, retired Sr. Deputy Secretary, CSIR, and Shri P.S. Venkateswaran, retired

Registrar of Indian Institute of Science, Bangalore, who had been invited to coordinate the session, gave their remarks on the aspects of 'Quality'.

Shri Kaushika explained the historical background of the CSIR Administrative set-up and emphasized the need for a new orientation to the work culture in Administration in the context of new developments in CSIR. He said that an administrator behind the system plays a crucial role in the success of the system: "Whatever is best administered is the best". He exorted the delegates to cultivate the habit of listening to the other's point of view also, because it tests the correctness of the view held by you.

Shri Venkateswaran spoke about the three constituent factors of Motivation, viz. (i) the person himself; (ii) the work; and (iii) the environment. He observed that because of the primary importance of the person himself in the system of Motivation, it would be desirable to invest well in health care of the persons, particularly by way of regular medical check ups, more so for those above 40 years. He also stressed the need for a courageous innovative attitude in handling special situations, all with a strong mind to provide a supportive role to the scientific staff, and keeping always in mind that the scientific research is the core activity of the laboratory.

The following papers were presented: Need for Responsive Administration in CSIR to attain *CSIR Vision 2001* (Shri Hanumanth Lal, Sr. COA, CRRI, New Delhi); Aspects of Quality in Materials Management (Shri D. Chengaiah, Dy. SPO, CCMB); The Energy of Change in Quality for *CSIR Vision 2001* (Shri Y. Ramakrishna, S.O.(G), CCMB); Aspects of Quality in Establishment Matters (Shri K.A.R. Sastry, S.O. (G), IICT); Administrative Effectiveness in the context of Quality and Motivation (Shri Yatinder Chauhan, DSPO, CSIR Complex, Palampur); The Sapthapadhi of Quality in Administration (Shri K.R. Sarma, Sr. COA, CCMB); Aspects of Quality in Finance Management (Smt. N. Padma, FAO, CCMB). Dr R.C. Garg, Director, Advanced Data Processing Research Institute, Secunderabad, delivered a special lecture on 'Computers for Quality in Administration'.

The important observations made during the discussions that followed on the first day are:

(i) CSIR Administration has a strong scope for more effective performance.

(ii) Materials Management policy in the Rationalized Purchase Procedure should be reviewed to further promote the quickness and quality in procurement of stores.

(iii) Preparedness for change in the new trends initiated by CSIR management has to be built up by a matching exercise of an overall change in perspectives of all the concerned, viz. scientific staff and the different units of Administration, for mutually dependent contribution to the fulfilment of the goals.

(iv) Positive attitude and appropriate management philosophy, consistent with the innovative work culture in CSIR, has to be brought up by appropriate orientations.

(v) A regular system of training at all levels of staff in Administration must be introduced and maintained.

(vi) Play of discretionary role by an Administrator in deserving cases must be supported and not discouraged; if necessary, a body may be authorized to exercise such discretion at the laboratory level.

(vii) The functional barriers between the units of scientific, technical and administration must be removed.

(viii) Simplified manuals delinked from government rules, capable of being easily understood by all concerned, must be introduced and maintained well and improved constantly.

(ix) Practice of choosing suppliers on the basis of prices alone must be ended.

(x) The constraint of fear in the minds of administrative staff must be removed so that they are able to deliver still better output.

(xi) Introduction of cost analysis identifying unwanted expenses should be made so that the budget available is used to a maximum value.

(xii) The need for funds for different projects must be scrutinized at the beginning of the year by discussion among all the concerned including the Finance and Purchase, and Planning personnel and the Scientists.

(xiii) Audit should be given a new orientation.

(xiv) A proper understanding of the process of scientific research and application of relevant factors of scrutiny should be developed to see whether the funds have been utilized in a manner as close to initial planning as possible, etc.

(xv) There is a need for a conscious and vigorous action in the form of resource persons meeting and talking to the units separately and together periodically to ensure the removal of psychological barriers between the different participating units in the organization.

The second day began with a session on 'Motivation'. Dr K.V. Raghavan, Director, IICT, Hyderabad, gave a keynote address. He pointed out that research is now like a business, and the business of research is conducted by selective operation of projects through a tunnel method, rejecting less profitable projects, as profitability is a bottomline of business. We are in search of professional excellence and, therefore, poverty in group task accomplishments must be eradicated. It is common knowledge that every person's likes and dislikes should be noticed and heard and, therefore, for administrative staff also, similar to what is available to scientific and technical staff, avenues of recognition may be introduced. He suggested the introduction of a Reward System in this direction.

Dr Raghavan emphasized that Administration has to provide an enormous backing to the extremely difficult research tasks which are undertaken under hazardous circumstances. Administration should understand the complexities of present and future and must imbibe among themselves positive attitude, quick and proactive attitude, an attitude of alerting the superiors of visualized adverse consequences, if any. He described a motivated administrator as one who sees Administration as a flow of positive change; as one who says — How a job can be done?; who sees innovation as a path for excellence. In difficult and complicated problems, most of these being unique, it is necessary for an Administrator to break the problem into its constituent units, analyze which of these are difficult and which are easy and arrive at overall workable solutions on that basis.

He suggested that Administrators should share their views with others like one lamp helps another to radiate light. They should infuse their solutions with novelty, and handle even complicated situations coolly, enjoying the opportunity to handle the situation. Even if it is necessary to say 'No', it is good to say 'No' in a proper way. A helpful officer converts even difficult rules to an advantage. An administrator with a dedication assumes a hypothetical risk of hire and fire system in his employment, so that he benefits from the stress generated. He is not content with *status quo* and keeps himself abreast with current trends for continuous improvement of the process.

The keynote address by Dr Raghavan was followed by an invited lecture by the Faculty of Management & Resource Development Foundation (MRDF), Hyderabad, with Dr B.R. Sant as the Leader of the faculty, on the topic: 'Communication as a Tool of Motivation'. The core theme of the lecture was on 'Effective Listening & Effective Public Speaking', factors which are very vital. An important message given by the three faculty members is that effective listening & effective public speaking, employing fully the faculties of eyes, ears, body and voice establishes a healthy inter-personal relationship and an effective rapport, thus bringing out a harmonious result in the group efforts.

Shri S.P. Kaushika, Shri P. S. Venkateswaran, the Coordinators for the Session, gave leading remarks. The following papers were presented: The Panchatantra of Motivation (Shri K.R. Sarma, Sr. COA, CCMB); Improving Work Culture in Administration through Motivation (Shri C. Badarinath, COA, CSMCRI, Bhavnagar); and Aspects of APAR from the point of view of Motivation (Shri M.S.N. Murthy, Administrative Officer, IICT).

Also, copies of a paper by Shri Suman Kanti Roy, Section Officer (F&A), IICT, entitled 'Vipassana for Motivation and Quality in Administration in CSIR' were circulated among the participants. The message conveyed by this paper was that meditation eliminates tensions and negative elements like jealousy, ego, anger, etc., and is therefore useful for enhancing motivation and quality in administration.

Prizes were given for best paper in each of the two themes 'Quality' and 'Motivation' and for best slogans. Best paper prizes went to Smt. N. Padma, FAO, CCMB for her paper on 'Aspects of Quality in Finance Management', and Shri K.R. Sarma, Sr. COA, CCMB, for his paper on 'The Panchatantra of Motivation'. In addition, a consolation prize was given to Shri C. Badrinath, COA, CSMCRI, for his paper on 'Improving work culture in Administration through Motivation.

The best three slogans chosen for the prizes are as follows: Positive Thinking enhances Quality in Administration (Shri K.A.R. Sastry, Section Officer(G), IICT); Positive Attitude and Practical Innovation the *'Mantra'* for Quality Administration (Shri Yatinder Chauhan, Dy. S&PO, CSIR Complex, Palampur); and Positive Attitudes help Everyone get the Most Out of Life (Shri K.A.R. Sastry, Section Officer (G), IICT).

The seminar concluded with the valedictory function presided over by IICT Director Dr K.V. Raghavan. Prior to this, the Coordinators conducted open house discussions in which several important points emerged:

1. Innovative practices in Administration are a welcome feature in the overall interest of the organization, even if they involve deviation from rules. For a high quality performance, it is essential to orient the Administrators on a healthy managerial path. The recommendations formulated as an aftermath of a training programme conducted by CSIR wherein several measures and recommendations were made with regard to simplification of the rules and regulations suited to institutional culture of CSIR and the other welfare measures to motivate the staff so as to achieve quality in administration and motivation among CSIR labs seem to be relevant even now. CSIR Headquarters may consider to adopt them.

2. In consonance with the policy of regular transfers of common cadre staff, it is essential to alleviate the hardships by appropriate concessions, like: (a) earmarking of quarters of entitled type (instead of next below type out of turn), (b) furnishing of.quarters, (c) educational allowance, (d) warm clothing allowance for postings at all winter stations, etc. The delegates requested for expeditious action on the recommendations of the Housing Committee under the Chairmanship of Dr K.V. Raghavan.

3. Simplified manuals of CSIR, delinked from SRs/FRs/Financial/Service Rules of Central Government are essential. This would ensure easy understanding by all concerned dealing hands at all levels, the customers of Administration, i.e. the scientific and technical staff. By that, quality combined with speed of work will be enhanced.

4. As the 'work by itself' is an important factor in Motivation, it is essential to enrich the work value of Administrative Head and the staff under him. The devolution of authority to COA which the bye-laws prescribe may be implemented so that accountability is matched by authority. The present practice of discretion of the director to delegate is not working well.

5. Adequate scheme of monetary incentives for meritorious work, applicable to all levels of administrative cadres on selective basis is essential to prop up the ambition for higher levels of quality work. It is desirable to introduce merit awards for the administrative staff for outstanding performance, similar to that available to scientific/technical staff, to inspire them for high levels of quality and recognition.

6. It was opined to have a uniforam promotion policy for administrative staff similar to that available to Group II of technical staff. Introduction of such assessment promotion policy for the administrative staff of the local cadre would provide the very much needed timely recognition which is otherwise not available in the present system.

7. Regarding the System of 'Amalgamated Cadre' it was felt that 'one year' of working as Section Officer by a Private Secretary prior to appointment as Under Secretary/Administrative Officer is inadequate and this period may be enhanced to atleast two years.

8. It was expressed that the transfers are in-built feature in the system of common cadre, and promote infusion of new ideas and new ways of working by transferred officers from one laboratory to the other. But the hardships emerging from the periodical transfer policy can be softened by appropriate concessions as brought out in the papers presented in the seminar.

9. The need to introduce an APAR kind of CR for administrative staff was also expressed on account of its advantages, viz. (i) the assessee is aware of his grading and is, therefore, able to up-scale his abilities and (ii) openness minimizes intentional subjectivity.

10. The need was also felt for a systematic promotion ladder for Translators and Hindi Officers in the Rajya Bhasha units of CSIR Headquarters and laboratories, in the absence of which the concerned incumbents do not have any driving enthusiasm in their respective work.

11. Regarding normalization process in APARs, the participants were informed that a CSIR Committee is examining the norms required to be followed by the Normalization Committee.

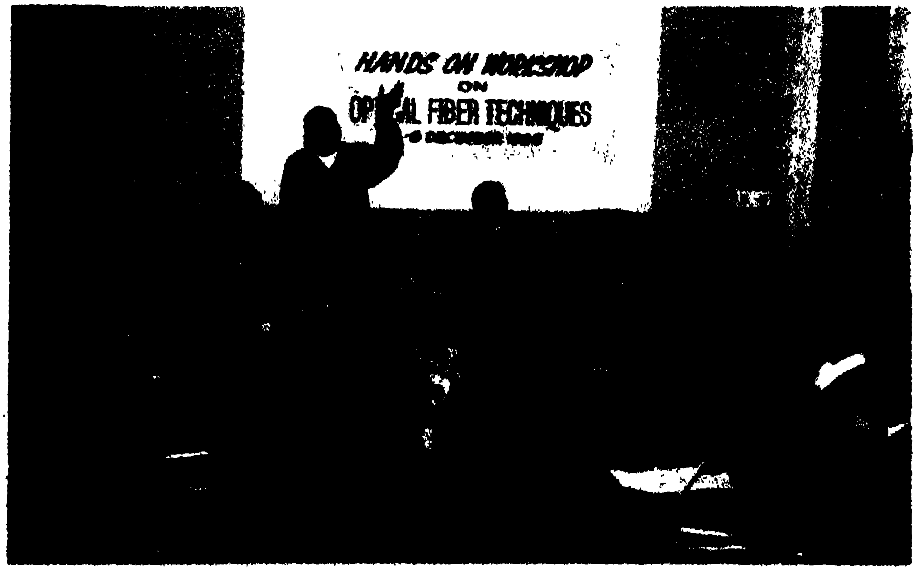
12. It was suggested to hold such seminars once every year; the venue of the next seminar was proposed to be NCL, Pune.

Shri G. Lenin, COA, IICT, welcomed the gathering to the valedictory function, which was presided over by Dr K.V. Raghavan, Director, IICT. Dr N.R. Rajagopal, retired Head, HRDG, CSIR, New Delhi, addressed the delegates as the Chief Guest and released the copy of 'SAMYUKTA' containing the messages and papers for the seminar. Prof. D. Balasubramanian, Director, CCMB, also attended the function. Smt. Shakti Balasubramanian distributed the prizes and mementoes to the winners of the best papers and best slogans and memontoes to dignitaries. On behalf of the delegates, Shri Yatinder Chauhan, Dy. Stores & Purchase Officer of CSIR Complex, Palampur, felicitated Shri S.P. Kaushika and Shri P.S. Venkateswaran with 'Angavastram'. The programme concluded with a vote of thanks by Shri M.S.N. Murthy, Administrative Officer, IICT. ❑

Workshop on Optical Fibre Techniques

A hands on workshop on 'Optical Fibre Techniques' was organized at the Central Scientific Instruments Organisation (CSIO), Chandigarh, with a view to providing high quality training to those interested in practical aspects of Fibre Optics Technology. The programme aimed at enhancing technical skills of engineers and managers involved in installation, maintenance and operation of fibre optic systems and the faculty personnel from the academic institutions. The programme was conducted in the Coherent Optics Division Laboratories of CSIO on 4-6 December 1996, under the leadership of Dr A.K. Aggarwal, Head of the Division. The hands-on training included cable preparation, termination, connector attachment and polishing, splicing and measurement of fibre attenuation, numerical aperture and refractive index profile. Fibre optics system design for communication of audio, video and data signals on optical fibre cable was brought home, with emphasis on practical aspects of designing such systems. Detailed workbook comprising tasks to be performed, techniques to be learnt and background information on fibre optics was provided to the participants. Nine trainees representing government departments, educational institutions and industry participated. They performed practicals and interacted with the faculty which was drawn from CSIO.

In the valedictory session chaired by Prof. K.R. Sarma, Director, CSIO, the developments, potentials and challenges in the area of fibre optics were highlighted and discussed. In the feedback on the course, the participants expressed that because of its practical orientation the course was highly useful, and such training courses should be organized more frequently. ❑



Prof. K.R. Sarma, Director, CSIO, Addressing the participants during valedictory session of the workshop on Optical Fibre Techniques

Molecular Structure Determination

A new 200 MHz Fourier Transform Nuclear Magnetic Resonance (FT- NMR) facility with a superconducting magnet has been commissioned in the Sophisticated Analytical Instruments Laboratory at Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar. The spectrometer, only one of its kind in Gujarat and Rajasthan, with capabilities of determining molecular structures in both solutions and solids is a non-destructive technique with applications in chemistry, biology and medicine. The facility was inaugurated by Prof. P. Natarajan, Director, CSMCRI, on 25 February 1997.

A workshop on Molecular Structure Determination by Spectroscopy and Diffraction was organized on this occasion in which Prof. Girjesh Govil (TIFR, Mumbai) delivered a keynote address on 'Biomolecular Structure from NMR Spectroscopy' Following this, invited lectures were given by Prof. V. Krishnan (IISc, Bangalore), Prof. T.P. Singh (AIIMS, New Delhi), and Prof. P. Natarajan. Deliberations were made on the application of various spectroscopic and diffraction techniques for structure determination of macromolecules like proteins nucleic acids, in drug design and discovery of new fluorophoric materials. Recent developments in FT-NMR instrumentation and X-ray diffraction techniques were also discussed by experts from the industries. The programme was attended by participants from academic institutions, universities and chemical, drug and pharmaceutical industries.

Dr D. Srinivas, Convener of the workshop, expressed his happiness over the enthusiastic response from the academia and industries from Gujarat, and hoped that CSMCRI with a spectrum of sophisticated instruments and highly qualified scientific manpower will soon become a focal point of active research interaction between the laboratory and industries. ❑

TRAINING COURSES

Application of Fuels and Lubricants in Automotive and Industrial Machines

A one-week training course on 'Application of Fuels and Lubricants in Automotive and Indutrial Machines' was organized at the Indian Institute of Petroleum, Dehra Dun, from 16 to 21 December 1996. Eighteen sales engineers from Hindustan Petroleum Corporation Ltd (HPCL) attended the course.

Shri D.W. Raut, Deputy General Manager, Technical Services (Marketing), was the Chief Guest at the inaugural function. Speaking on the occasion, Shri Raut urged the trainees to make full use of the opportunity provided by the course and update themselves to cope with the present petroleum scenario in the country.

Describing IIP as a "temple of learning and a *veda* of petroleum information" he expressed great confidence in the training capabilities of the institute's Training Division headed by Dr Himmat Singh. He said that today's customer is well informed and knowledgeable and we have to be ahead of him with greater knowledge in order to help and guide him.

The course concluded with a brief valedictory function in which Dr T.S.R. Prasada Rao, Director of the institute, awarded certificates to the participating engineers. Addressing the participants and other members present on the occasion, Dr Prasada Rao said that it is not the concluding of the training course but it is a beginning of new era of opportunities and challenges laying ahead for the participant sales engineers. He expressed confidence that the training provided by IIP faculty, which is considered one of the best in the country, will go a long way in helping them in their career.

The course was co-ordinated by Dr Mathew Abraham and Shri V.P. Sharma, both scientists at IIP. ❑

Shri D.W. Raut addressing the participants at the inaugural function of training course on Application of Fuels and Lubricants in Automotive and Industrial Machines. Seated on the dais are the Himmat Singh and Dr V.R. Sista

Stabilization and Filling Issues for Ground Control

A five-day course on 'Stabilization and Filling Issues in Raniganj and Barakar Measure Seams for Ground Control' was organized in Dhanbad, commencing from 23 December 1996.

Welcoming the guests and course participants, Dr S.K. Sarkar, Deputy Director, Central Mining Research Institute (CMRI), Dhanbad, said, "The problem of stabilization in Raniganj and Barakar coalfields has been created because of the unscientific mining in the past. Besides many engineering problems, it has given rise to various socio-economic problems which have been aggravated further owing to migration of a huge number of people into that area from within and outside the state". Anunconventional approach might have to be thought of to mitigate this highly complicated problem, he added.

Shri C.K.V.N. Rao, Director (Technical), BCCL and Chief Guest on the occasion, inaugurated the course and presented a brief outline of the problem, starting from its genesis. He suggested to tackle the issue by taking into account the problems created owing to mining in the past, present mining practices and problem of mine fire. He also pointed out that BCCL could not be held responsible for the occurrence of subsidence over old workings which had been created before the formation of BCCL.

Shri R.K. Paul, General Manager (HRD), BCCL, expressed grave concern over the problems of stabilization which need a lot of attention.

Shri S.K. Mukherjee, Scientist, CMRI, and Course Coordinator, spoke about the topics of the course.

Shri R.P. Singh, Scientist, and Incharge of HRD Cell, CMRI, proposed a vote of thanks.

The valedictory function of the course was organized on 27 December 1996. Delivering the valedictory address, Dr S.M. Kolay, Director (Technical), BCCL, said, "Stabilization problem in Jharia and Raniganj coalfields has assumed a serious condition and needs a speedy solution".

Welcoming the guests and participants, Prof. Dhar said, "The recent worldwide search has shown that no specific technology is available to stabilize the affected areas effectively and at the same time economically". He opined that subsidence is there to stay in certain areas as a result of continuous mining and the time dependence property of the standing old pillars below ground. "Stabilization as practised today by conventional method may not be an immediate solution, but in the long run it could perhaps help, that too, if the filling operations underground are effective and the stowing material reaches the places where necessary".

Dr T.N. Singh, Scientist F, CMRI and Shri R.K. Paul, General Manager (HRD), BCCL, also spoke on the occasion.

Dr Kolay gave away the certificates to the course participants. ☐

Dr S.K. Sarkar, Depty Director, CMRI, speaking during inauguration of the training course on Stabilisation & Filling Issues for Ground Control. Others (from left) are: Shri R.K. Paul, General Manager (HRD), BCCL; Shri C.K.V.N. Rao, Director (Technical), BCCL; and Shri S.K. Mukherjee, Scientist, CMRI

Commercial Cultivation of Gladiolus

IN order to popularize the cultivation of gladiolus as well as to boost the development of cut flower industry, a five-day training course was organized by the National Botanical Research Institute (NBRI), Lucknow, on 'Commercial Cultivation of Gladiolus' from 27 to 31 January 1997. The course was sponsored by Small Industries Development Bank of India. Shri Anil Vidyarthi, General Manager, SIDBI, Lucknow, inaugurated the course. Speaking on the occasion, Shri Vidyarthi explained the various schemes offered by SIDBI in this direction. Dr P.V. Sane, Director, NBRI, welcomed the participants and explained the role of floriculture in modern day life and its potential as a cash crop. Dr S.C. Sharma, Head, Botanic Garden and Principal Coordinator of this course, gave a brief resume and genesis of the training course.

A total of 26 trainees comprising progressive farmers, entrepreneurs, retired bureaucrats and housewives attended the course. Both, theory and practical classes were organized with the help of audio-visuals and by arranging field demonstrations covering different aspects, viz. introduction, cultivation, diseases

Training course on Commercial Cultivation of Gladiolus: Dr S.C. Sharma, Head, Botanic Garden, NBRI, conversing with the trainees at the Gladiolus field at Kakori near Lucknow

and pests control, post-harvest technologies, marketing and techno-economics along with a field trip to Kakori to visualize the magnitude of gladioulus cultivation in and around Lucknow. The trainees were given certificates on the successful completion of the training course, by the NBRI Director.

Dr M.R. Ahmad, Head, Information, NBRI, compered and conducted the programme. Dr A.N. Sharga, Scientist, Botanic Garden, proposed a vote of thanks. ❑

Dr S. Husain Zaheer Young Scientist Award

DR S. Husain Zaheer Young Scientist Award presentation function was organized at the Indian Institute of Chemical Technology (IICT), Hyderabad, on 7 January 1997, under the auspices of Zaheer Science Foundation, New Delhi.

The Foundation was founded in the memory of Dr S. Husain Zaheer -- an outstanding scientist, administrator and institution builder who is like a father figure to IICT. He served as Director of the Regional Research Laboratory (now IICT), and, later as Director General of CSIR. The Foundation was registered in Delhi under the Societies Act of 1890 with the prime objectives of giving awards, scholarships, fellowships and grants to individuals/teams of scientists and technologists and organizations for specific projects in scientific, industrial, economic and social research of significance. Besides organizing popular lectures and symposia, the Foundation has instituted the Zaheer Award for the best research contribution to oil chemistry and paint technology. Dr S. Husain Zaheer Young Scientist Award for the best and outstanding research work done in the field of organic chemistry was instituted in 1988. The award carries Rs 5000 and a certificate of appreciation.

Welcoming the gathering at the present function, Dr K.V. Raghavan, Director, IICT, praised Dr Zaheer's qualities of head and heart. He said that it was Dr Zaheer who as Director General of CSIR pioneered in forging close linkage between CSIR laboratories and industry, thus transforming CSIR into an R&D think-tank for industrial expansion in the country. After his retirement as Director General CSIR, Dr Zaheer was actively engaged in research activities as an Eminent Scientist in RRL-Hyderabad, encouraging and guiding younger scientists of the laboratory. It was in the fitness of his this contribution that the Foundation instituted Young Scientist Award in his memory.

Shri T. Krishna Reddy, Deputy Director & Head Research Management Area, IICT, in his introductory remarks, said that ever since the award was instituted by the Foundation, award presentation function was being held at IICT. The award committee consists of eminent organic chemists of the country like Prof. Goverdhan Mehta, Vice Chancellor of Hyderabad University, Hyderabad; Dr Nityanand, former Director, Central Drug Research Institute, Lucknow, and Dr A.V. Rama Rao, former Director, IICT. The committee is headed by Dr G.S. Sidhu, former Director of IICT and later Director General, CSIR.

Prof. R. Kumar, of the Indian Institute of Science, Bangalore, who is also Chairman, CSIR Technology Advisory Board for Chemical Sciences, was the chief guest. He presented the award to Prof. M. Periasamy of University of Hyderabad, and Prof. A. Srikrishna of the Indian Institute of Science, Bangalore, for

Prof. R. Kumar, IISc, Bangalore, giving the Dr S. Husain Zaheer Young Scientist Award to one of the awardees

the years 1992 and 1993, respectively. The award winners made 30-minute presentations highlighting their contributions to the field of organic chemistry. Shri R.N. Parlikar, Senior Deputy Director and Head, Design and Engineering Division, proposed a vote of thanks. ❑

DEPUTATION BRIEFS

Dr G.A. Ravishankar

DR G.A. Ravishankar, Head, Plant Cell Biotechnology Department, Central Food Technological Research Institute, Mysore, was deputed to China during 2-11 December 1996 to attend International Seminar on Spirulina Development, held at Kunming. This visit was sponsored by China Rural Technology Development Centre, Beijing. He delivered a lecture on 'Emerging Prospects in Spirulina Biotechnology' with special reference to newer applications in the area of food, feed, pharmaceuticals and speciality chemicals. He also chaired a session on standard specification of Spirulina. This seminar was attended by nearly 100 participants including 14 international experts from countries such as USA, Japan, Germany, Israel, Thailand, Taiwan, India and Singapore. The discussion at the symposium involved large-scale production of spirulina, maintenance of quality and application in food, pharmaceutical and chemical industries and also on emerging trends in development of photo bioreactors. The seminar was followed by field visit to Changai Lake, Yunnan Province, wherein spirulina industries are located. The visit to Changai was sponsored by Yunnan Spirin Company Limited.

Dr Ravishankar also visited Yunnan University at Kunming to interact with scientists working in Biology and Agricultural Biotechnology. The spirulina technology developed at CFTRI has already been transferred to a leading industry in India which is producing spirulina biomass of international quality. This visit provided a good opportunity to interact with international experts, which will prove to be useful in improving the project work at CFTRI. ❑

ANNOUNCEMENTS

International Conference on Frontiers in Biotechnology

THE Regional Research Laboratory (RRL), Thiruvananthapuram, and the Department of Biotechnology, New Delhi, are jointly organizing an international conference on 'Frontiers in Biotechnology' at Thiruvananthapuram.

The conference, to be held during 26-29 November 1997, will have plenary (40 min.) and invited lectures (25 min.) and poster sessions for contributory papers in the following areas: Industrial Biotechnology, Food and Pharamaceuticals, and Environmental Biotechnology. Some major topics proposed to be discussed include: Cell Biology and Genetics, Microbial Cultivation System, Solid State Fermentation, Microbial Production of Value-added Products, Bioprocess Development, Downstream Processing, Microbial Synthesis and Chemistry of Bioactive Compounds, Fat and Lipid Biochemistry, Biosensors, Biodiversity, Eco-friendly Products and Processes (Biofertilizers, Biopesticides, Biopolymers, Biopulping, Bioleaching, Bioremediation & Biotransformations), Biodegradation of Environmental Pollutants, Biological Detoxification, and Waste Management.

Participation is open to anyone involved in Biotechnology R & D, Planning, Consultancy, etc. from all over the world. Prospective participants are invited to present posters [a selected number of these will be considered for oral presentation (10 min. each)]. They should submit an abstract of about 250 words in duplicate to the convener of the conference immediately. Registration fee: $200/ Rs 2500 up to 31 August and $250 / Rs 3000 afterwards. In order to encourage participants from universities, special reduced registration fees will be offered to them. Candidates who wish to avail this facility must make a written request to the convener while submitting their abstracts.

Further information can be obtained from: Dr Ashok Pandey, Convener, ICFB '97, Regional Research Laboratory, Thiruvananthapuram, 695 019. Tel : 91-471-490 674; Fax: 91-471-490 186, 491-712; E-mail: pandey @csrrltrd. ren. nic.in. ❑

Seminar on Recent Advances in Structural Dynamics and Aeroelasticity

THE National Aerospace Labroatories (NAL), Bangalore, is organizing the seventh National Seminar on Aerospace Structures (NASAS) on 13-14 August 1997 at NAL, under the sponsorship of Aeronautics Research and Development Board (ARDB). The theme of this NASAS is 'Recent Advances in Structural Dynamics and Aeroelasticity' especially related to aerospace structures and systems.

The last NASAS on 'Structural Dynamics' was held in 1990. Since then many important developments have taken place in this area, both at the international and national level. Many projects like LCA, ALH, PSLV, GSLV, IGMDP, *Hansa* and UAVs undertaken in the country have triggered significant developments in R&D as well as in applications. Finite element structural analysis and the use of composites are playing increasingly important roles in the design and development of structures. Further, the potential of smart materials and structures is being explored to provide more efficient and cost-effective design alternatives involving active control and aero-servo-elasticity. The seminar is intended to bring together experts and specialists in the field to share their experiences and views.

The following topics in the area of structural dynamics and aeroelasticity have been identified for the seminar: Analysis, Design, Testing, Tailoring, Optimisation, Active Control for Structure Control Interaction, Aero-Servo-Elasticity, Fluid-Structure Interaction, Vibration Control, Smart Structures and Studies Qualification & Certification.

Further details regarding the seminar can be had from: Shri C.G. Shah, Convener, Organizing Committee, 7th NASAS and Deputy Head, Structures Division, NAL, PB No. 1779, Bangalore 560 017. ❑

Training-cum-Demonstration Programme on Improved Technologies for Cultivation and Processing of Important Medicinal & Aromatic Plants

THE Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, is organizing the title programme during 23-25 April 1997. Sponsored by SIDBI, Lucknow, the objective of this programme is to popularize the improved technologies of cultivation and processing of medicinal and aromatic crops among the growers and entrepreneurs with a view to help increase the production of these plants and their products for internal consumption and export, and also make economic utilization of wastelands.

The programme will cover:

- Medicinal and aromatic plants of economic importance, their present status and improved technologies for cultivation and processing.
- Improved field distillation unit and its operation.
- Purification and storage of essential oils.
- Marketing of essential oils and crude drugs.

Training will be conducted at CIMAP Campus located at a distance of about 14 km from Lucknow Railway Station, near the Kukrail forest.

The registration fee for the course is Rs 1500, and the facility for on-the-spot registration is also available.

All correspondence regarding the programame should be addressed to: The Director, CIMAP, P.O. CIMAP, Near Kukrail Picnic Spot, Lucknow 226 015 (UP). Phone: 0522-342683 (Director); Gram: MEDPLANTS, LUCKNOW; Fax: 0522-342666. ❑

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit

Annual Subscription : Rs. 60
Editor : Dr B.C. Kashyap
Editorial Assistant : Neelima Handoo
Production : Kaushal Kishore
Single Copy : Rs. 3.00

ISSN 0409-7467

CSIR NEWS

CNRS-CSIR Pact for Joint Research in Frontier Areas of S&T

CENTRE National De La Recherche Scientifique (CNRS), France, has entered into a three-year agreement with the Council of Scientific & Industrial Research (CSIR), India, to carry out joint research in frontier areas of Science & Technology. An agreement to this effect was signed on 3 April 1997 at the CSIR Headquarters, by Prof. Guy Aubert, Director General, CNRS and Dr R.A. Mashelkar, Director General, CSIR and Secretary, Department of Scientific & Industrial Research. The agreement is the outcome of wide-ranging discussions that the CSIR scientists had with a high-powered French delegation led by Prof. Guy Aubert. Prior to signing the agreement, the delegation visited the following CSIR labs/instts to have a first hand account of R&D capabilities of CSIR: Centre for Biochemical Technology, New Delhi; Centre for Cellular & Molecular Biology, Hyderabad; Indian Institute of Chemical Technology, Hyderabad; National Environmental Engineering Research Institute, Nagpur; National Institute of Oceanography, Goa; National Chemical Laboratory, Pune; and National Physical Laboratory, New Delhi. The delegation also visited the National Institute of Immunology, New Delhi; Ranbaxy Laboratories, New Delhi; University of Hyderabad, Hyderabad; and the International Centre for Genetic Engineering & Biotechnology, New Delhi.

The broad areas of cooperation between CNRS and CSIR, *inter-alia*, are:

- Genome Sequencing and Analysis including Bio-Informatics
- Microbiology including Diseases caused by Microorganisms
- New Approaches to Drug Design and Pharmacological Studies on Potential Drugs
- Bio-diversity and Ecology
- Evaluation of Scientific Productivity
- Social Implications of Biology such as Relationship between Biology & Law
- Environmental Technology and Energy
- Oceanography
- Chemical Sciences. ☐

NEERI-IOCL Agreement for Tail Gas Desulphurization at Mathura Refinery

THE National Environmental Engineering Research Institute (NEERI), Nagpur, has been retained on 26 March 1997 by the Indian Oil Corporation Ltd, for design and installation of full-scale plant on microbial desulphurization of Claus tail gas at Mathura Refinery. The gas contains 2-3% (v/v) of H_2S and 0.8-1.0% (v/v) of SO_2, discharged at the rate of 2000 kg per hour at a temperature of 135°C.

The plant includes cooling system, caustic scrubber for selective removel of SO_2, chemical oxidation unit for treatment of H_2S with concomitant production of elemental sulphur, sulphur recovery units, fixed film bioreactors for generation of oxidant for reuse in the process, and heating system for treated gas prior to its release into the stack.

The scope of work includes design, detailed engineering, procurement, supply, inspection, construction, testing, commissioning, and guaranteeing of civil, mechanical, electrical, instrumentation and piping works. The agreement is signed for Rs 132 million. The plant will be commissioned in nine months, with performance guarantee period of 12 months after commissioning, and handing over to Mathura Refinery. ❑

Starting from 1 April 1996, considerable amount of R&D work has been carried out both at SERC, and Institute für Sicherheitforschung and Reaktortechnik Forschungs-zentrum, Germany. The workplan for development of the finite element software modules employing a *posteriori* error estimation and adaptive refinement techniques hás been finalized after detailed discussions between SERC and KFA. ❑

SERC-KFA Project on Efficient and Reliable Finite Element Analysis of Structures and Components

THE Finite Element Method (FEM) is popular for analysis of complex structure. Discretization of the model for a physical structure is the basic requirement in using the FEM. Despite the significant advances made in theories and algorithmic tools of Discretization methods, selection of the computational model for a particular problem has been largely based on intuition and experience gained from solving similar problems.

The Structural Engineering Research Centre (SERC), Chennai and KFA, Germany are pursuing a project which aims at the development of reliable a *posteriori* error estimates as well as adaptive refinement strategies by which a required accuracy of the finite element solution can be reached most economically. With the exponential growth in networked computing resources and the feasibility of high speed communications through LANs, clustered workstations provide significant computational capability for solving practical engineering problems employing adaptive finite element techniques and parallel FE techniques. Efficient partitioning strategies especially for unstructured meshes and dynamic load balancing techniques for adaptive finite element analysis with appropriate parallel solution techniques employing iterative and direct solvers will be employed. The user related input will be controlled using a graphical user interface which will aid the user in modelling and understanding the structural behaviour.

OBJECTIVES OF THE PROJECT

Adaptive refinements for finite element (FE) analysis of structures.

Implementation of parallel FE analysis on cluster of workstations using MPI as software development environment.

Implementation of adaptive procedures in the parallel FE analysis with suitable load balancing techniques.

Development of a graphic use interface for interactive FE analysis on X-Windows and Motif.

Treatment for Protection of Steel Reinforcement in Concrete

CORROSION of reinforcement is amongst the most important causes of deterioration of reinforced concrete. Concrete cracking occurs because of the insoluble corrosion products, rust, which has a volume 2.2 times more than metallic iron. This volumetric expansion imparts internal tensile forces to the concrete causing cracking and spalling. The use of organic coating has been considered to be the best solution of this problem.

The Central Building Research Institute (CBRI), Roorkee, has developed an epoxy/phenolic interpenetrating network polymer (IPN) coating. And to evaluate the behaviour of this coating alongwith some commercial available coatings used for such application, the following tests have been conducted: chemical resistance as per IS: 13620-1993, accelerated corrosion test by weight change method, pullout test for bond strength as per IS: 2770 - 1967, and chloride ion resistance test by salt spray method as per IS: 9844-1981.

For studying the behaviour of these coatings on steel, reinforcing bars — conventional steel bars and corrosion-resistant steel bars — were taken, and two coats of these coatings were applied. After curing the coating for three days at room temperature (27±2°C), concrete samples were prepared by embedding these coated bars in the two concrete mixes, i.e. M20 and M25, having two cover of thicknesses (15 and 25 mm). After curing, these samples were subjected to accelerated corrosion cycle test. One cycle consisted of one day immersion in 5% sodium chloride solution followed by drying for three days at room temperature and next three days at 60°C. It was observed that after 80 cycles, the sample having IPN coated steel bars remained intact, and no surface cracking was observed while bars coated with Nitrozinc (zinc-rich epoxy coating) and polyurethane got cracked. In the case of samples prepared by using uncoated bars in M20 concrete, hair crack was observed after 45 cycles. A hair crack was also observed in M20 concrete with corrosion-resistant steel bar after 50 cycles. The same phenomenon was observed with M25 concrete after 50 and 55 cycles respectively.

To understand the phenomenon of deterioration of concrete and corrosion of reinforcement, physico-chemical (pH, Cl, DTA) studies were carried out during different periods of exposure.

Efforts are being made to correlate the data generated with the rate of corrosion of the reinforcing bars.

The treatment is cost effective having very good performance and can be applied at site.

The process has been licensed to the following three parties :

(1) M/s Krishna Conchem Products
5 B, Mohsin Building,
R.K. Vaidya Rd., Dadar (W)
Mumbai 400 028.

(2) M/s Konkan Polycons
D-3/21 San Coale
Industrial Estate, Zuari Nagar
Goa 403 726.

(3) M/s Kamal Chhabaria
Kamal Chhabaria Constructions
B- 103, Green Field
Lokhand Wala Complex
Andheri (W)
Mumbai 400 053.

❑

CRRI develops Impact Tester

THE California Bearing Ratio (CBR) is an indicator of material strength. To find out CBR values, different techniques have been developed but most of these are laborious and time consuming. To measure field CBR value of soils, the Central Road Research Institute (CRRI), New Delhi, has developed a device called 'Impact Tester' which is portable and enables the determination of CBR values of a large number of samples in a very short time.

The device consists of a compaction hammer equipped with an accelerometer which is connected to a digital electronic display which measures the strength of soil sub-grade through dynamic impact value.

CRRI's Impact Tester

The impact tester can be used for testing the design and construction of pavements, subgrades and earthworks and to confirm uniform compaction over wide areas.

The device has been patented and the technology transferred for commercialization. ❑

Performance and Durability of Multiblend Cement

THE Central Building Research Institute (CBRI), Roorkee, has finalized four formulations of multiblend cements incorporating large quantities of industrial by-products and wastes, viz. fly ash, blast furnace slag and a cheap retarder, i.e. low-grade gypsum. Chemical analysis of each blending component complies to the desired composition specified in the relevant Indian Standards. Studies on suitability of these multiblend cements have been carried out for long-term performance and durability on sulphate-resistance perfect soundness and resistance to aggressive environments.

Sulphate Resistance

Studies on sulphate resistance were carried out by using varying amounts of the component gypsum as retarder (normal dose is 4%) in large proportions. The multiblend cement sample (MBC-1) containing PC 40%, blast furnace slag 45%, and fly ash 15% by wt was taken and the amount of gypsum was raised from normal dose to 5%, 6%, 7% and 8%. The strength development was determined in 1:3 cement mortar cubes cured under water at 27±2°C for various periods. It was observed that the sample containing 6% gypsum has maximum strength.

Soundness

It was found that for maximum strength, the multiblend cement should contain: portland cement 40 to 60%, granulated blast furnace slag 25 to 45% and fly ash 15% by wt. These cements were found to be perfectly sound under the autoclave bar expansion test and exhibited greater resistance to aggressive conditions than ordinary portland cement. Further studies regarding identification of phases by instrumental technique and durability under aggressive environments are in progress.

Salient Features of the Multiblend Cements:

- Low permeability
- High early strength
- Low-cost
- Desired and reasonable setting time
- Better resistance to aggressive environment.
- Require less energy in their manufacture

Uses

These new type of multicomponent blended cements are being successfully used in advanced countries in all type of construction activities, including roads and bridges, providing higher strength beside saving on capital investment.

Advantages

These cements help utilize industrial wastes such as fly ash, blast furnance slag and cheaper inorganic mineral additive i.e. gypsum. The major benefits are the reduction in environmental pollution and saving on energy. Furthermore, the overall production can be enhanced without any substantial increase in capital investment.

CBRI would be glad to interact with manufacturers interested in producing these multiblend cements. ❑

Geraniol-rich Citronella Strain

GERANIOL ($C_{10}H_{18}O$), an unsaturated primary terpene alcohol, is highly valued in perfumery and as a base for a large number of semisynthetic aroma chemicals. Its major source is palmarosa (*Cymbopogon martinii*). Although palmarosa profitably grows in tropics, its cultivation in subtropics, especially in foot hill areas of Uttar Pradesh has not been economic. In view of this, the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, took up studies to find suitable substitute crop for palmarosa for production of geraniol in these areas. The CIMAP's Pantnagar Field Station has identified a spontaneous tall mutant of *Cymbopogon winterianus* Jowitt (Java citronella) which profusely grows in both tropical plains as well as subtropical foot hills, and has greatly robust growth habit with the essential oil rich in geraniol (60%). Assessment of productivity in clone population of this geraniol-rich citronella (GRC) against two standard checks of palmarosa and jamrosa (Interspecific hybrid of *C. nardus* var. *confertiflorus* and *C. jawarancusa*), have shown improvement in GRC over the checks for the six promising characters studied. The increase in yield of geraniol in GRC over the two checks was about 50 and 56%, respectively. The yearly averages for per hectare geraniol yield in the three genotypes (GRC, palmarosa and jamrosa) were 150.7, 100.4 and 96.4 kg, respectively. While Java citronella is cultivated in the country for commercial production of citronellol and citronellal, development of its mutant chemovar. GRC, would further boost its commercial cultivation for production of geraniol. It is envisaged that GRC would be a good substitute crop for palmarosa for the production of geraniol in foot hills of Uttar Pradesh. Olfactory evaluations are in progress that would fix the market value of the geraniol quality. ❑

Environmental Mutagens, Carcinogens, Pollutants — Low-level Exposures and Their Biological Effects

KEEPING in view the recent findings that environmental pollutants can also induce mutagenicity and carcinogenecity, it has become very important to discuss and pool together all the new knowledge coming from scientists in these areas. The Environmental Mutagen Society of India (EMSI), with its affiliation to the International Mutagen Society, USA, has been holding conferences each year in different parts of India in the month of February, to bring together scientists working in the area of mutagens and carcinogens.

The 22nd Annual conference of EMSI was held at the Indian Institute of Chemical Technology (IICT), Hyderabad, from 6 to 8 February 1997. The main aim of the conference was to 'create awareness in the field of environmental mutagens (which are DWA damaging agents), carcinogens (chemicals which induce cancers in human beings, studied through animal models) and pollutants (which have maligned the surroundings of human beings and are effecting the health of humans). The conference dealt with the useful and harmful effects of ultraviolet radiation, its biological effects and the importance of the low-level exposures. The conference had eight technical sessions on important topics like:

- Genetic and Cancer Epidemiology
- Genetoxicity and Carcinogenecity
- Mutagenecity and Carcinogenecity
- Environmental Hazards and Risks
- Cytogenetics and Biomarkers
- Toxicology at Low-level Exposures
- Cancer Epidemiology
- Bioremediation.

The conference was inaugurated by Shri Rangachary, Principal-Secretary, Departament of Forests, Environment & Science & Technology, Government of Andhra Pradesh, in the IICT Auditorium. Dr K.V. Raghavan, Director, IICT, welcomed the participants who came from various parts of the country and abroad. Guest of Honour Dr G.Thyagarajan, COSTED, Chennai, released a souvenir brought out on the occasion, and Dr P.C. Kesavan, President of EMSI, presided over the function. Dr Kaiser Jamil, Deputy Director and Convener, introduced the theme of the conference. Dr U.S.N. Murty, Assistant Director, IICT, proposed a vote of thanks.

The conference had a galaxy of speakers. Dr Raghavan, in his plenary lecture, highlighted the risk assessment of hazardous waste disposal from process industries. He said that hazardous pollutants from industries, if not properly disposed, can impair the surrounding ecosystem and can pose threat to the survival of living species contained within the system. International concern in this area has resulted in the need for making qualitative risk assessment of the disposal of hazardous wastes into the soil and water bodies. Hence, he said, quantitative risk assessment (QRA) of hazardous waste with references to the human and non-human biota places this problem in its proper perspectives.

Dr Meera Khan, Visiting Professor from The Netherlands, gave a special lecture on molecular aspects of colon cancer. Dr Shelley Bhattacharya of Shantiniketan, West Bengal, highlighted the effects of pesticides in living system.

Dr G. Thyagarajan, ex-Director, IICT (presently at COSTED, Chennai), releasing the souvenir during seminar on Environmental Mutagens, Carcinogens and Pollutants—Low-level Exposures and Their Biological Effects. Seated at the extreme left is Dr K.V. Raghavan, Director, IICT

Dr A.T. Natarajan, a member of the Medical Faculty of Leiden University, the Netherlands, stressed the importance of FISH (fluoroscent *in-situ* hybridization technique) using non-radioactive DNA sequences, which has revolutionized the field of cytogenetics.

Dr S. Lalchev from Sofia, Bulgaria, spoke about heavy metals, their effect on genes and determination of their effects (test systems). Dr Y.R. Ahuja (Genetics, Hyderabad) explained about yet another assay, 'COMET', which has become famous for detecting various harmful effects, and can also be performed in microbial systems, Drosophila and mammalian systems.

Shri G.M. Ayling, Manager of Hyderabad Waste Management Project, Hyderabad, discussed the place of Bioremediation in India, and Dr Kaiser Jamil delivered a plenary lecture on 'Bioremediation *per se*: scope and perspectives.' These two speakers focussed the issues of biological remediation of pollution in a special session on 'Bioremediation' which was held at REC, Warangal on 8 February 1997. Dr Kaiser Jamil highlighted bioremediation as a kind of environmental medicine to the ecosystem and added that like most diseases, there is need for care-specific evaluation and treatments.

The conference was attended by 150 delegates and several PG students and research scholars. Some students and other participants presented posters on their findings, and contributions to the emerging trends in toxicology and molecular biology. ❑

Foundation Day Celebrations at CDRI

THE Central Drug Research Institute, (CDRI), Lucknow, celebrated its forty-sixth Foundation Day on 19 February 1997. Dr R.A. Mashelkar, Director General, CSIR and Secretary, Department of Scientific & Industrial Research, Government of India, graced the occasion as Chief Guest and Prof. P.N. Tandon, Chairman, CDRI, Research Council, presided. Other dignitories present were Dr Val Hemming, Dean, USUHS; Dr Radha Maheshwari, Coordinator, Indo-US Collaboration and Professor of Pathology, USUHS, USA; and distinguished members of the scientific and medical community of Lucknow.

Dr V.P. Kamboj, Director, CDRI, welcomed the guests and briefly recapitulated the major achievements and activities of the institute during the past one year. He said that it was a great privilege for the institute that the then Prime Minister of India, Shri P.V. Narasimha Rao released the institute's two new drugs, one diagnostic kit and two process technologies to industry for commercialization, on 28 February 1996.

The new drugs, diagnostic and technologies released are: Chandonium iodide, a neuromuscular blocking agent, licensed to Cipla Ltd, Bombay; Standardized *Brahmi* Extract, a herbal remedy for memory improvement, commercialized by Velvette International Pharma Industries Ltd, Chennai; Leishmaniasis diagnostic kit, an antibody-based diagnostic kit for kala-azar, commercialized by Span Diagnostics Ltd, Surat (Gujarat); Acyclovir, an antiviral agent, licensed to Ranbaxy Labs Ltd, New Delhi; and Leuprolide, a LHRH agonist, licensed to Cipla Ltd, Bombay.

Dr V.P. Kamboj, Director, CDRI, delivering the Foundation Day lecture. Seated on the dais (from right) are: Dr R.A. Mashelkar, Director General, CSIR; Prof. P.N. Tandon, Chairman, CDRI Research Council; and Dr B.S. Srivastava, Deputy Director & Head, Microbiology Division

The institute strived towards fulfilment of its motto — licensing/development of one new drug/herbal remedy/diagnostic/technology annually. Consequently, a new antimalarial drug, arteether, jointly developed with the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow; a herbal remedy for diabetes; and process technology for a known antimalarial drug, melfloquine, were developed. In keeping with the CDRI tradition, mefloquine technology was licensed to M/s Wockhardt Ltd, Aurangabad, on this day.

The year also witnessed the successful marketing and wide public acceptance of the standardized *Brahmi* extract licensed last year. This has further accelerated the confidence and pace of development/standardization of traditional Indian remedies.

The institute's R&D programmes continued to be directed towards the development of drugs in national priority healthcare areas, namely family planning, malaria, filariasis, kala-azar and drug- resistant bacterial and fungal infections, and in internationally emerging new disease areas namely liver disorders, immunomodulators, osteoporosis, memory disorders, diabetes and wound healing. The leads from the traditional systems of medicine were explored for management of these diseases.

The present status of candidate drugs under clinical trials and technologies for generic drugs is as follows:

- **Centpropazine** (antidepressant) — Marketing permission has been obtained and licensing to industry is being explored.
- **Consap** (local contraceptive cream) — Phase III clinical trial is in progress at medical colleges and family welfare centres.
- **Centchroman** (breast anti-cancer)— Phase III multicentric trial has been completed and the data are under compilation.
- **Compound 80/53** (antirelapse antimalarial) — Phase II clinical trial has been concluded and dossier is being compiled.
- **Compound 81/470** (anthelmintic) — Phase I clinical trial data have been compiled and submitted to DCG(I) and permission for Phase II clinical trials received.
- **Phase II and III veterinary trials** against round worm infection in sheep, goat and poultary have been successfully completed. Efficacy comparable to fenbendazole has been observed.
- **Compound 82/437** (antifilarial)— has been found to be safe in single dose tolerance study in healthy volunteers. In multiple dose tolerance study it was devoid of any side effects.
- **Picroliv** (hepatoprotective) — Results of Phase II clinical trial were quite encouraging.
- **Compound 80/574** (hypolipidaemic) — Phase II clinical trial in patients of hyperlipidaemia have shown encouraging results.
- **Centbutindole** (neuroleptic) — In comparison to haloperidol, centbutindole has revealed an early onset of antipsychotic effect in patients showing negative symptoms of schizophrenia. This seemed to be the major difference as both the drugs show improved global score over six-week therapy and similar side effect profile.

Process technology for **fluoxetine** has been developed at laboratory scale, with overall yield of 44%. Scale-up and optimization of technology of **ketorolac** is under progress and process for making intermediates of **diltiazam** has been standardized.

Under the institute's broad-based primary biological screening programme 700 new compounds synthesized at the institute, 192 received from other institutes and universities, 102 plant extracts and 143 extracts of marine flora/fauna were screened using 170 *in vitro* and *in vivo* test systems. Leads were obtained for liver disorders, antihypertensive-cum-cardioprotective, anti-ulcer, wound healing and antidiabetic activities, and the national/international pharma partners interested in their further development are being explored.

The drive to prepare the institute to meet Intellectual Property Right challenges and demands of the industry in new drug development gained momentum as evidenced by the introduction of several *in vitro* test systems for quick screening, maintenance of secrecy and timely patenting of new leads and persuits of good laboratory practices.

Despite emphasis on speedy development of new products, novel process technologies and business development activities, the institute accorded due priority to basic research as a committed strategy for generating new knowledge/leads.

Dr Kamboj informed with pride the progress achieved on the international front. The institute's compound Ormeloxifene had entered Phase II clinical trial for osteoporosis and the results were encouraging. An agreement for synthesis/purification of a peptide hormone (adreno-

corticotrophic hormone-ACTH) was signed with a Swedish company (Ferring Peptide Production AB, Sweden), and ties with ZymoGenetics, USA/Novo Nordisk, Denmark, were further strengthened by licensing one more compound. International projects with Walter Reed Army Institute, USA, on drug resistance in malaria and with Uniformed Services University of Health Sciences, USA, on Simian malaria progressed satisfactorily. The pharmaceutical industry, both national/international, has thus shown great confidence in the institute's programmes, products and capabilities.

The national level facilities namely National Laboratory Animal Centre (DBT), Regional Sophisticated Instrumentation Centre (DST), National Information Centre for Drugs and Pharmaceuticals (DSIR), Advanced Centre for Pharmacology Research (ICMR) and National Project on 'Development of Potential Drugs from the Ocean' (DOD) performed well during the year. Dr Kamboj expressed his gratitude to the agencies for their support. Parasite Bank, another national level facility, received support from DBT. The institute extended facilities for regulatory toxicity, biological screening and hormone assays to industry and academia.

Like previous years, CDRI scientists received several honours and awards in recognition of their remarkable contribution to science

Dr V.P. Kamboj exchanging the document of agreement signed with Dr Anders J. Andersen, Managing Director of Ferring Peptide Ltd, Sweden (top); Explaining CDRI's programmes and achievements to the visiting Chinese delegation led by Prof. Zhou Ming Jiang, Chinese Academy of Science (middle); and with the members of the delegation led by Dr T.K. Koichuev from Kyrghyzstan.

and technology; Dr B.S. Srivastava received Shri Om Prakash Bhasin Award; Dr G.K. Patnaik, Samanta Chandra Sekhar Award; Dr (Smt.) Madhu Dikshit, Shakuntala Amir Chand Prize; Dr Asim Ghatak, elected Fellow of Indian College of Physicians; Dr Vinod Bhakuni, CSIR Young Scientist Award; and (Smt) Pratima Srivastava, INSA Young Scientist Award. Dr V.P. Kamboj himself received Ved Prakash Seth Foundation Award, Dr B.N. Ghosh Lecture Oration Award and Gujral-Bhargava Oration Award. Dr Kamboj congratulated the awardees and research students who received Ph.D./D.Sc./M.D. degrees during the year.

Under the human resource development programme, 51 candidates from the academia and industry, including six scientists from Bangladesh, Myanamar and Nepal and students from Barkatullah University, Bhopal and BITS, Pilani were trained in various R&D disciplines.

The institute organized several conferences and workshops. It also organized exhibitions and open houses on CSIR Foundation Day and Science Day during the year. Biomedical interactive lectures arranged in collaboration with INSA, NASI and IMA local chapters, continued with good response.

Mellanby Memorial Oration

The Mellanby Memorial Oration organized in memory of Sir E. Mellanby, first Director of the institute also coincides with this great day. Prof. Van G. Hemming delivered the 22nd Melanby Memorial Oration, and enlightened the gathering with his talk on 'Immunity and the enigmatic respiratory syncytial virus'. The function was presided over by Dr N.K. Ganguly, Head, Department of Experimental Medicine, PGIMER, Chandigarh.

In addition to the major R&D accomplishments highlighted by CDRI Director Dr Kamboj, some other significant R&D activities of the institute during 1996-97:

Primary Biological Screening

Of the samples screened (700 new compounds synthesized at the institute, 192 received from other institutes and universities, 102 plant extracts and 143 extracts of marine flora/fauna), five compounds, three plants and four marines showed anti-implantation activity; two compounds showed anti-osteoporosis activity; four compounds showed antifilarial activity; five compounds had antimalarial activity; three compounds and four plants showed antileishmanaial activity; two compounds and one plant and one marine showed antiamoebic activity; three plants showed antigiardial activity; two plants and two marines showed antiviral activity; one plant and four marines were found to have antibacterial/antifungal properties; three compounds, two plants and one marine were hepatoprotective; two compounds showed wound healing activity; one compound had anti-PCA activity; three plants and 11 marines showed hypoglycemic activity; two marines showed hypolipidaemic activity; one compound had antidepressant activity; one plant and one marine had hypotensive activity and seven compounds and two plants showed immunostimulant activity

Performance Indicators

New drugs/diagnostics/process technologies released for commercialization:	4
Projects pursued	
(i) Regulatory Studies:	21
(ii) Project Area Studies:	>110
Grant-in-aid projects/services:	8
Sponsored projects :	50
Contract research assignments:	3
Papers published:	125
Patents filed :	12
Budget:	Rs 222.969 million
ECF:	Rs 100.578 million (estimates)

Amongst the earlier compounds/plant products screened, leads identified for further development are:

Compound 87/132 (spermicidal, anti-HIV) has been found safe in toxicity/irritancy tests. Vaginal suppository and foam tablets have been prepared.

Compound 93/478 (antihypertensive); **94/573** (antiulcer); **92/213** (hepatoprotective); **93/637** (wound healing); **95/220** (anti-PCA); **CDR 134** (anti-diabetic); and **CDR 159** (antiamoebic) have been identified for detailed bioevaluation and filing of national and international patents.

Several *in vitro* screens have been developed and standardized for quick screening of compounds. Two hundred and ten compounds of different structural prototypes were screened for antileishmanial activity using these tests; the activity criteria being inhibition of parasite SOD and ^{3}H-thymidine incorporation, reduced proliferation of amastigotes in the macrophage-amastigote culture system, decrease in promastigote viability as evident by microscopic examination, and reduction in MTT value. There appears good correlation amongst these tests.

β-Galactosidase reporter system has been constructed in mycobacteria for screening of antitubercular drugs.

Antifertility Agents

Compound 85/287 (antiimplantation agent) is under evaluation in higher animals.

Among the three potential spermicidal agents (compounds 87/132, 88/553 and 93/243) studied, compound 87/132 has been found to posssess a better therapeutic index as compared to compound 88/533 identified for development earlier; it also has anti-HIV activity.

Tropical Infections

Phase III clinical trial of **Arteether** (antimalarial blood schizontocide) has been completed in uncomplicated and complicated cases of *P. falciparum* malaria and the data submitted to Drugs Controller General (India); the marketing permission has been received.

Two promising antimalarials, **Compounds 93/123** and **166** have been found to be gametocidal and devoid of any adverse pharmacological effects.

Definite relationship has been established in the higher concentration of the enzyme glutathione-S-transferase and chloroquine resistance in *P. berghei, P. yoelii* and *P. falciparum;* the drug sensitive strains have been found to have lower level of the enzyme.

Of the biochemical and physiological parameters evaluated, glucose uptake and ATP of parasites appear promising markers for *in vitro* evaluation of antifilarial activity.

NMR spectroscopy has been successfully utilized for investigating parasite metabolism and mechanism of drug-parasite interaction. Besides, ultrasonography has been employed to test drug efficacy on adult parasite (*W. bancrofti)*

CVS, CNS and Other Disorders

Compound 93/478 has been found to exhibit significant antihypertensive and cardioprotective (anti-ischaemic) activities.

Compound 96/637 has shown promising wound healing activity both in diabetic and adiabetic wound models.

Compound 92/213 has been found to possess significant hepatoprotective activity as revealed by its effect on hepatic glutathione, serum sorbitol dehydrogenase and lactate dehydrogenase — enzymes found to be sensitive biochemical markers for evaluation of hepatoprotective activity.

A decrease in peroxide levels and enzyme and non-enzymic antioxidants in cutaneous wound tissue has been demonstrated. The findings suggest that by increasing the antioxidants level of wound, the healing could be posssibly facilitated.

A significant reduction in glutathione and glutathione peroxidase activities and increased catalase activity has been noted in pyloric ligation-induced ulcer in rat.

There appears to be involvement of superoxide radicals, hydrogen peroxide and hydroxyl radicals in norepinephrine and serotonin induced rat aortic ring contractions.

Exploitation of Natural Products

Significant activity has been reported in the following natural products, terrestrial plants/marine flora and fauna:

Plant No.259 (hepatoprotective) — The active fraction derivative has been found most active on isolated hepatocytes.

Plant No. 3964 (hypoglycemic) — Activity confirmed in repeat collection.

Plant No. 74 (wound healing) — Isolated compound showed promising activity in animal model on topical application and oral administration.

CDR-80 (antiviral) — A cerebrocide isolated provided 50% protection against EMC virus.

CDR-91 (hypotensive) — A cerebrocide showing hypotensive activity has been isolated.

CDR-131 (hepatoprotective) — Activity has been confirmed in the extract of repeat collections.

CDR-134 (antidiabetic) — A fraction obtained has shown high order of activity which has been confirmed in repeat collections.

CDR-159 (antiamoebic) — A fraction obtained provided 90% of clearance of caecal amoebiasis; activity also confirmed in three pure compounds obtained.

Biologically Active Peptides

Two glycopeptides, compounds 88/524 and 89/779 have been found to be active in mouse SRBC model.

Inclusion complexes of the compound 82/205 (analgesic) with β-cyclodextrin were evaluated for the analgesic activity in rats. One of the complexes (complex-B) has been found to be twice more potent than the parent compound.

A few new analogs of IgE Fc fragment have been evaluated for antiallergic activity in the rat model, and the compound 96/199 has been identified for further studies.

A synthetic peptide corresponding to the epitope region of the major antigen of *A. fumigatus* has been identified. The peptide can replace the active antigen for serodiagnosis of *A. fumigatus*.

Diagnostics

Leishmaniasis (kala-azar) — The diagnostic test for leishmaniasis based on antigen detection in the urine sample of patients has been validated in additional urine samples from infected and normal subjects. No cross reactivity was observed in patients suffering from tuberculosis, leprosy, viral fever and malaria.

Single dose of killed *L. major* vaccine obtained from WHO did not provide protection against *L. donovani* infection in monkeys, but when given with BCG, all the three monkeys were protected.

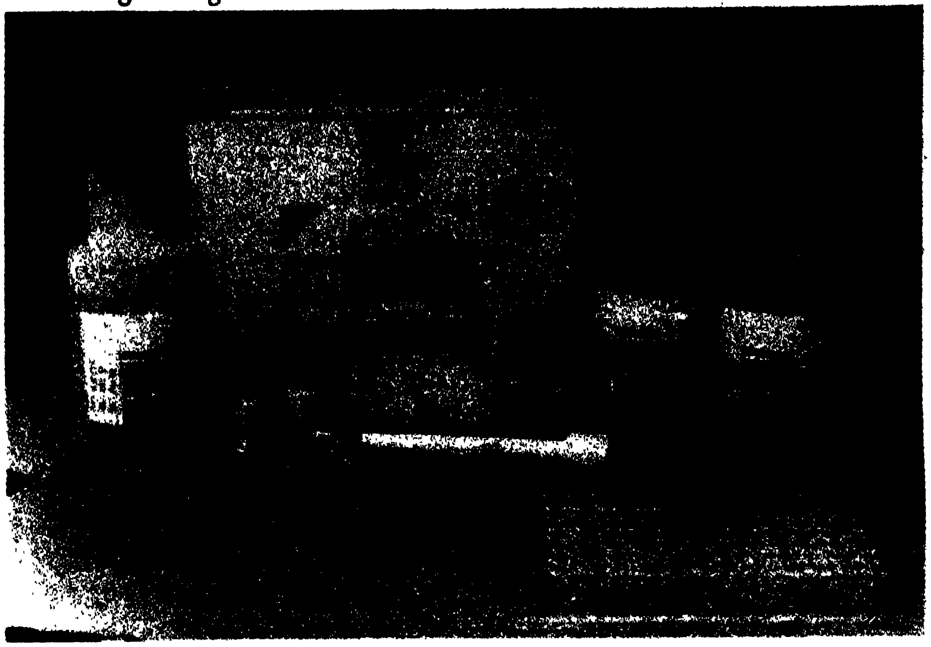
Malaria — Anti-LDH polyclonal antibodies prepared have been found to be effective in very small quantity (1µg) in immunodot enzyme assay using patients' sera.

Filariasis — A sandwitch ELISA technique has been standarized using monoclonal (SC1-SC6) and polyclonal (SC1) antibodies; the latter have been found to be better for detection of circulating antibodies.

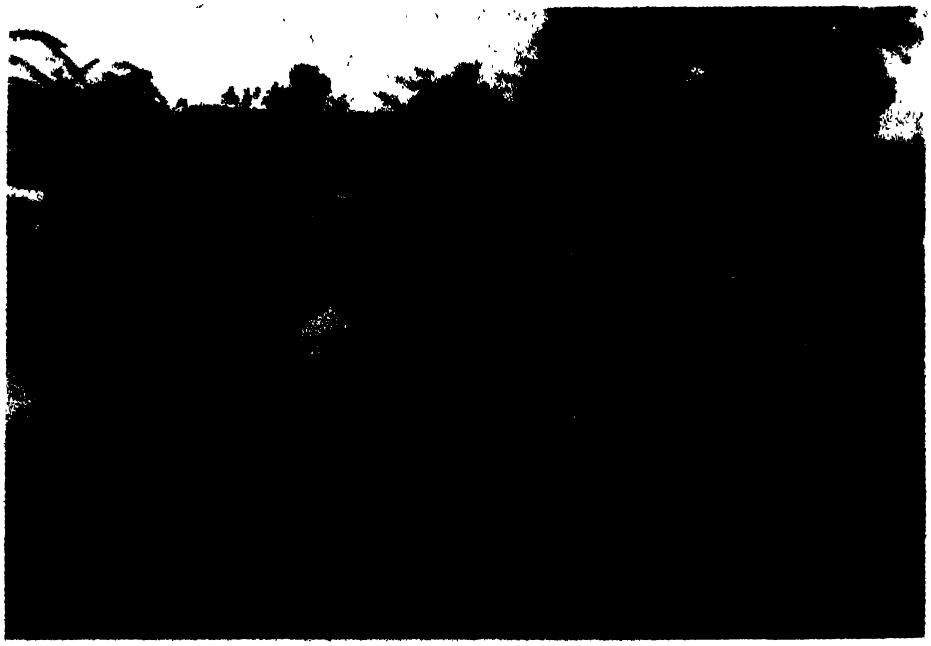
Tuberculosis — Evaluation of DNA probe developed for diagnosis of *M. tuberculosis* with coded samples from PGIMER, Chandigarh, has demonstrated 100% specificity to the microbe.

Aspergillosis —A 70kDa antigen of *A. fumigatus* has been evaluated with patients's sera of disseminated aspergillosis and it appears to be specific. The anti-70 kDa antibodies did not react with other fungal antigens.

Vaccines — Protection by 33 and 53 kDa antigens of 01 cholera strain has been evaluated in RITARD model (at NICED and CDRI) and the degree of protection found to be same as in ileal loop model. There was no LPS contamination. The partial nucleotide sequence of the regulatory gene does not reveal homology to toxR gene.



Leishmaniasis diagnostic kit, 'Leishma Test'



CDRI scientists conducting an epidemiological survey of kala- azar in a village of Varanasi district

M. habana cell associated antigens, which provide protection against experimental tuberculosis, are preferentially distributed in peripheral membranes but diagnostically important antigens reside in integral membranes. The secretory proteins of *M. habana* have been found to induce lymphocyte proliferation and DTH response and protective mice against experimental tuberculosis.

Two proteins (116 and 66 kDa) isolated from *B. malayi* have been found to be protective in rodents.

Technology Development

Synthetic/Plant-derived drugs — Among the institute's synthetic products, Centpropazine and other compounds (compounds 78/103, 80/574 and 81/470) and the natural product Picroliv were prepared for various studies. The process for herbal remedy for memory has been optimized and demonstrated to the industry and process for the isolation of another herbal remedy (hypoglycemic) standardized.

Fermentation Products — *Bacillus thuringiensis kurstaki* (biopesticide) cultivation has been scaled up to 1500 L fermenter level; 100 kg of biopesticide formulation has been sent for field trials on sugarcane crops.

L-lysine yield has been achieved up to 75 g/L in 150 L size fermenter.

Lactic acid yield in the form of calcium lactate up to 120-150 g/L has been achieved at bench scale level.

Lipase preparation having 43000-114000 units/g of acetone precipitated crude protein has been obtained.

Pharmaceutical Formulation — Vaginal suppository of compound 87/132 (spermicide) has been developed and sufficient quantities prepared for preclinical studies.

A stable dispersible formulation of compound 81/470 (anthelmintic) has been developed for veterinary trials.

Quality control parameters for fraction F062 of Plant No. 324 (antileishmanial), a plant extract CT-1 (hypoglycemic) and *B. thuringiensis kurstaki* (biopesticide) have been developed. ❑

CONFERENCE BRIEFS

Indo-Japan Seminar on Oxide Electronics

THE above seminar was held in Chiba (Tokyo), Japan, during 23-24 February 1997. Prof. C.N.R. Rao, President, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, was the Coordinator from the Indian side and Prof. M. Itoh, Tokyo Institute of Technology, Yokohama, from the Japan side. There were six members in the Indian delegation and an equal number of scientists in the Japan delegation coming from various parts of the two countries. Prof. G.V. Subba Rao, Director, Central Electrochemical Research Institute, Karaikudi, also attended the seminar as a member of the Indian delegation.

The experience, expertise and facilities available in the two countries with regard to various pure and mixed oxide materials exhibiting the following properties were thoroughly discussed: (i) Giant magneto resistant materials, (ii) Superconducting materials, (iii) Ferro electric materials (iv) Valency degeneracy materials (v) Oxide materials with ladder type structures.

Prof. C.N.R. Rao gave an excellent overview of transition metal oxides (pure and mixed), their interesting physical and physicochemical properties. He also mentioned about the outstanding problems to be solved with respect to understanding their behaviour, mechanism based upon molecular and ionic approach and problems encountered during fabrication, testing and reproducibility in devices.

Various techniques of synthesis like thin film, thick film, controlled epitaxy, single domain, multi domain bulk materials and the dimensionality of the materials were discussed in details by the participants, and some samples were exchanged for further studies. It has been decided that new materials, including oxide materials and oxide electronics, will be included as one of the joint collaborative R&D projects to be taken up in the Ninth Five Year Plan between the two countries. It has also been decided to hold the next seminar in India after 2-3 years. A memento was presented by Prof. C.N.R. Rao to Prof. Itoh, leader of the Japan delegation.

The various participants and the talks delivered by them are as follows: C.N.R. Rao (Indian Instt. of Science & J. N. Centre for Advanced Scientific Research, Bangalore), Transition metal oxides: Outstanding problems; N. Kumar (Raman Research Institute, Bangalore), Electrical transport in highly anisotropic metallic oxides—Layered cuprates; A.K. Raychaudhuri (Dept. of Physics, Indian Instt. of Science, Bangalore), Conductivity noise in oxide films — Likely origin and implications on electronic applications; R. Pinto (Solid State Electronics Group, Tata Instt. of Fundamental Research Mumbai), Pulsed laser ablated oxide thin films: Synthesis, properties and device applications; G.V. Subba Rao (Central Electrochemical Res. Instt., Karaikudi), Valency degeneracy and metallic conduction in mixed oxide systems; P. Ganguly (Physical Chemistry Dvn., National Chemical Laboratory, Pune), Modified single-dip method for Langmuir Blodgett oxide films: Application for obtaining patterned ultrathin films; T. Kawai (ISIR-Osaka University, Ibaraki), Harmonic integration of functional metal oxide artificial lattices; M. Takano (Instt. for Chemical Research, Kyoto University), Chemical contributions in the new field opened by the discovery of HTSC: Pinning centres and spin ladders; H. Hoinuma (Ceramics Materials & Struct. Lab., Tokyo Instt of Tech.), Dimension controlled epitaxy of quantum functional oxides; M. Kuwabara (Dept of Materials Science, University of Tokyo), Electrical properties of single grain boundaries in PTCR barium titanate ceramics; Y. Tokura (Dept. of Applied Physics, University of Tokyo), Magnetic and Photonic phase-control in Perovskite manganites; and M. Itoh (Materials & Structures Lab., Tokyo Instt. of Tech), Attempt to control electric and magnetic properties of perovskite by 3d ordering.

Prof. Subba Rao also visited the University of Tokyo during 25-26 February and held discussions with Prof. A. Fujishima and Prof. K. Kitazawa regarding photo electrochemistry, spin coating of materials, transparent conductors, superconducting oxides, magneto resistance and electrochemical room temperature oxygen intercalation.

He also visited Osaka National Research Institute, Osaka (27-28 February), and gave a seminar and held discussions with Dr S. Higuchi, Head, Battery Section, Dept of Energy Conversion, on various types of battery materials, high energy density battery, molten carbonate and solid oxide fuel cells. ❑

Processes licensed and sponsored projects/technical jobs taken up by CECRI

THE Central Electrochemical Research Institute (CECRI), Karaikudi, has demonstrated and licensed its process on Air drying synthetic enamel paint to Shri V. Arumugam of Karaikudi, under the Scientist-Entrepreneur Scheme (lump sum premium: Rs 12,000, period of license: 7 yrs).

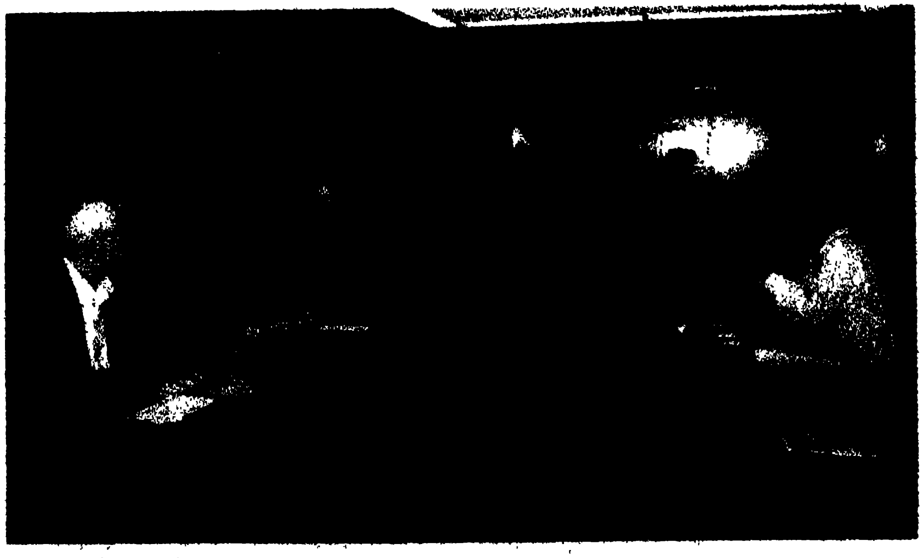
The sponsored projects taken up by the Institute during January-February 1997, include: Synthesis of novel materials by molten salt electrolysis [sponsored by Department of Science & Technology, (DST), New Delhi, Rs 966,000], and Fundamental and developmental studies on transparent oxide conductors (DST, Rs 601,000).

The technical assignments taken up during the above period are: Testing of aluminium alloy anodes by chemical and electrochemical analysis (Electroprotection Services, Karaikudi, Rs 50,000), Preparation and supply of platinum plating electrolyte from platinum scraps (Premal Consultants, Pune, Rs 45,000), and Testing of low-maintenance stationary lead-acid batteries of various capacities (Renewable Energy Systems, Hyderabad, Rs 210,000). ❑

Delegation of Science Counsellors at NAL

A delegation of Science Counsellors of the Embassies of Germany, Israel, Italy, Poland and USA, and British High Commission visited the National Aerospace Laboratories (NAL), Bangalore, on 18 February 1997.

The delegation was formally received by NAL Director Dr T.S.



Science Counsellors for USA, UK, Italy, Germany, Israel and Poland in conversation with NAL scientists

Prahlad. After welcoming the Counsellors and introducing his senior colleagues, Dr Prahlad made a detailed presentation on NAL's R&D activities and plans, with special reference to NAL's *SARAS* programme and its on-going international projects.

The Counsellors expressed their keenness to learn more about NAL programmes. "We are here to learn, look around and interact with your scientists", the Counsellors said. They also said that they would like the co-operation to filter down to more practical things "instead of restricting ourselves to routine exchange visits involving university professors". There was also some discussion on specific collaborative programmes between India and each of the countries represented in the delegation.

The visit concluded after a brief visit to some of the NAL's R&D facilities. The members of the delegation were: Dr S.F. von Welck, Germany; Mr Meir Eshet, Israel; Dr Giusto Sciarabba, Italy; Dr Tomasz Gerlach, Poland; Mr Michael White, UK and Dr Ronald M. Roberts, USA. ❑

Winter School on Atomic Force Microscopy

THE Central Scientific Instruments Organisation (CSIO), Chandigarh, organized a 'Winter School on Atomic Force Microscopy' (AFM) from 13 to 18 February 1997. The programme was sponsored under the Science & Engineering Research Council Scheme for Young Scientists, Department of Science & Technology, Government of India, New Delhi.

The atomic force microscopy is a spin off from scanning tunneling microscopy (STM) which was invented in 1986 by Dr Binnig and Dr Rohrer of IBM Research Lab, Zurich, for which they were awarded Nobel Prize. AFM has the capability of imaging both conductive and non-conductive surfaces of the samples, down to atomic resolution and, therefore, is more versatile than STM.

The winter school was inaugurated by Prof. D. Balasubramanian, Director, Centre for Cellular and Molecular Biology (CCMB), Hyderabad. Congratulating CSIO for developing STM and AFM, Dr Balasubramanian called upon the institute to develop the latest instrumentation for Fluorescent Correlated Spectroscopy.

About 15 scientists from various national labs and universities took part in this winter school, the main objective of which was to expose the young scientists to the latest developments in the field of Atomic Force Microscopy and characterization. Lectures as well as practical demonstration sessions were conducted during the programme.

While introducing the Chief Guest, Prof. K.R. Sarma, Director, CSIO, emphasized the need for continued interaction between CSIO and CCMB in using STM and AFM developed at CSIO.

Dr S.S. Wadhwa, Coordinator of the programme, intimated the participants that scanning tunneling microscopes developed at CSIO during the last five years have been assigned to M/s Vacuum Instruments

Left: Prof. D. Balasubramanian, Director, CCMB, inaugurates the winter school on Atomic Force Microscopy; Prof. K. R. Sarma, Director, CSIO *(right)* looks on. *Right:* Dr S.S. Wadhawa, Coordinator, addressing the inaugural session of the winter school

Company, New Delhi, for commercial production and sale to various users in the R&D labs. The programme concluded with valedictory address by Prof. D.V.S. Jain, Ex-Chairman, Chemistry Department, Panjab University, Chandigarh. ❑

IICB participates in Science & Culture Expo

SCIENCE & Culture Expo 96-97 was organized by the Central Calcutta Science & Culture Organization for Youth this year at Vivekananda Institution grounds, Howrah, West Bengal, during 12 - 19 January 1997. The theme of the Expo was 'High Tech in Rural and Urban Development, and Science for Humanity & Humanism'.

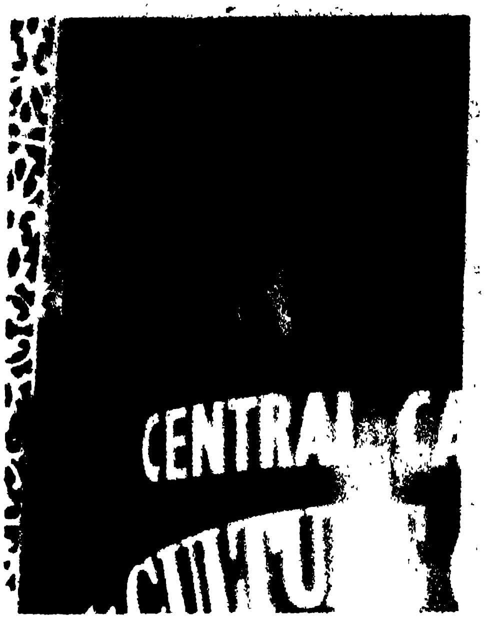
In this Expo, the BIOTECHNOLOGY Pavilion set up by the Indian Institute of Chemical Biology (IICB), Calcutta, for the Department of Biotechnology (DBT), Government of India, was adjudged as the 'Second Best Pavilion' by a team of experts and awarded a trophy and certificate of merit. The pavilion displayed exhibits from the following organizations: Regional Research Laboratory, Jammu; National Chemical Laboratory, Pune; Gujarat Agricultural University, Anand; Mahatma Phule Krishi Vidyapith, Rahuri; University of Agricultural Sciences, Dharwad; Indian Cardamom Research Institute, Spices Board, Kochi; Tropical Botanic Garden & Research Institute, Thiruvananthapuram; Central Tobacco Research Institute, Rajahmundry; DBT, New Delhi; Indian Council of Agricultural Research, New Delhi; Central Institute of Medicinal and Aromatic Plants and National Botanical Research Institute, Lucknow, IICB, Calcutta; Bose Institute, Calcutta; and Vivekananda Institute of Biotechnology, Neempith Ramakrishna Ashram.

The other important pavilions included those set up by Department of Science and Technology, Council of Scientific and Industrial Research, National Informatics Centre, Central Ground Water Board, Videsh Sanchar Nigam Ltd, Department of Electronics, Ordnance Factories Board, Directorate of Advertising and Visual Publicity, BSI, ITI, SAIL and Calcutta Port Trust.

The Expo was inaugurated in two stages: the first phase was opened on 12 January by Swami Sujit Maharaj of Ramakrishna Mission, Belur Math, and the second (Science & Tech) by Shri Kinjarapu Yerrannaidu, Union Minister for Rural Areas & Employment, on 13 January. Shri Yerrannaidu also inaugurated a seminar on 'High-Tech in Rural Development'.

The week-long programme included scientific seminars, cultural functions, drama along with Science and Technology exhibitions.

Prof. Yoginder K. Alagh, Minister of State for Planning & Programme Implementation and Science & Technology, visited the Expo pavilion on the 18th forenoon. He was also the Chief Guest at the seminar on 'Science for Humanity and Humanism'.



Prof. Y.K. Alagh, Minister of State for Science & Technology and Vice President, CSIR, addressing a seminar during the Science & Culture Expo held at Howrah

The Expo was visited by an estimated 120,000 people from different walks of life. The distinguished visitors included notable scientists like Dr Arabinda Bose (ex-Vice Chancellor, Jadavpur University), Prof. Rahul Sinha, Dr M. Balasubramanian (Adviser, DBT), Dr R. Mehrotra, Dr J. Das (Director, IICB), Shri T.C. Dutta (ex-Chief Secretary, Government of West Bengal), Shri Priyaranjan Dasmunshi (M.P.). Shri Ambika Banerjee (MLA) and Shri Swadesh Ranjan Chakraborty, Mayor of Howrah.

IICB also participated in the CSIR pavilion with six R&D exhibits. ❑

Dehydrated Floral Craft

THE National Botanical Research Institute (NBRI), Lucknow, is the pioneer institution in the country where work on dehydration of flowers and foliage as well as floral craft is being carried out since long. Floral craft has a good potential as a cottage industry, for generating self employment for the unemployed youths and a source for earning money by housewives and rural women. Also, in view of the increasing demand of floral craft products abroad it can also serve as a foreign exchange earner.

NBRI organized a training programme on 'Dehydrated Floral Craft' under the sponsorship of Small Industries Development Bank of India (SIDBI) from 17 to 21 February 1997. The training programme was inauguarataed by Shri Anil Vidyarthi, General Manager, SIDBI, Lucknow. Dr B.P. Singh, Seniormost Scientist, NBRI, welcomed the participants. Dr S.K. Datta, Head, Floriculture and Coordinator of the programme, gave a brief resumè and genesis of the programme.

A total of 30 trainees comprising unemployed youths, housewives and amateur flower growers attended the programme. It covered both theoretical and practical demonstrations. The participants were encouraged to learn different techniques, e.g. collection of plant materials, pressing, embedding in silica gel and sand, dehydration in hot air and microwave ovens, preparation of dry flowers arrangement as decorative items and post-dehydration care. A business group meeting was also arranged to make the participants aware of marketing potentiality, and help them start cottage scale industry on dehydrated floral craft. On this occasion, a colourful folder entitled 'Dehydrated Floral Craft' was also released. Dr M.R. Ahmad, Head, Information, compered and conducted the programme. ❑

Dr B.P. Singh welcoming the participants to the Training Programme on Dehydrated Floral Craft. Sitting on the dais (from left) are: Dr M.R. Ahmad, Dr S.C. Sharma, Shri Anil Vidyarthi and Dr S.K. Datta

D.Sc. (Honoris Causa) to Dr R.A. Mashelkar

THE Indian School of Mines, Dhanbad, has honoured Dr R.A. Mashelkar, Director General, Council of Scientific & Industrial Research and Secretary, Department of Scientific & Industrial Research, Government of India, with the Doctorate of Science (Honoris Causa) degree at its XIX Convocation held on 29 March 1997. Dr Mashelkar also delivered the convocation address as Chief Guest on this occasion. ❑

Shri B.K. Rao, Chairman, Executive Board, Indian School of Mines, conferring the D.Sc. (Honoris Causa) degree on Dr R. A. Mashelker, Director General, CSIR

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit
Annual Subscription : Rs. 60
Editor : Dr B.C. Kashyap   Editorial Assistant : Neelima Handoo   Production : Kaushal Kishore   Single Copy : Rs. 3.00

ISSN 0409-7467

CSIR NEWS

IICB develops New Radiotracers for Dynamic Nuclear Imaging of Human Organs

FOR the first time in India, a range of radiopharmaceuticals with high marketing potential has been developed through intensive basic research in the Nuclear Medicine Division of Indian Institute of Chemical Biology (IICB), Calcutta. These products are useful for evaluation of dynamic functions of human organ systems at cellular level by nuclear imaging. A commercial kit for evaluation of renal system has also been developed in this laboratory and application to clear this drug for clinical trial is presently being processed by appropriate authority. Though this discipline developed during the last two to three decades only, the commercial demand of these drugs had crossed billion dollar mark several years ago in developed countries, and in India it is over thirty million at present.

In Nuclear Imaging it is possible to portray complex biodynamics of human organ system like a movie, if some of the constituent biomolecules participating in the process have γ- radiolabel on them and the emitted γ-radiation from the human body can be photographed in rapid sequence by a camera. Such a camera was developed in 1957 and after five years, a suitable γ-emitting isotope (Technetium 99m) was available with acceptable nuclear properties (γ - 140 KeV; $t_{1/2}$-6h), for administration in human bodies in sufficient quantities to produce a picture of high resolution. To record the progress of this very informative discipline, the *Journal of Nuclear Medicine* was launched in the same year (1962).

The efficiency of the whole imaging procedure is dependent to a large extent on the availability of Tc-based radiopharmaceuticals. Tc is a metal, and only possible method to attach it to organic molecule is by chelation. Thus, it differs from more common radioisotopes like ^{14}C, ^{3}H, ^{32}P, ^{35}S and ^{125}I which are all nonmetals and are linked to organic molecule by covalent bonds. The strategy of developing a ^{99m}Tc radiotracer is to design a ligand which after chelation with ^{99m}Tc can mimic the chemical structure of some substrate indigenously present in human body. The substrate is so selected that its movement or location is associated with some kind of clinical disorder. The success of the imaging process depends largely on how closely we can mimic the substrate with ^{99m}Tc-chelate (see Fig.1).

Obviously, the above exercise needs a thorough knowledge of Tc chemistry. The fact is that in spite of numerous attempts, first Tc-chelate could be characterized only in 1978. In India, so far nobody except IICB ever attempted to synthesize or characterize any Tc-chelate, though it appears to be one of the most medically important element. In the last 19 years, technetium chemistry developed quite well but not to the extent so as to offer Tc- radiopharmaceuticals to enlighten every corner of human body. However, in spite of this handicap which is in-

Fig. 1 — X-ray crystallographic data (ORTEP diagram) confirms the successful mimicking of a renal physiological standard, i.e. hippurate [1] with Tc-cysteine [2] in terms of proximity and orientation of O_1 and O_3 for interaction with renal tubular transport protein causing profuse renal excretion of [2] comparable to hippurate [1]. The longer (2.15 Å) than normal (1.99 Å) Tc-O_4 distance observed in Tc-cysteine allows its interaction with cell lysozyme promoting renoscintigraphic studies. Such sophistication in drug design permits very specific targetting of kidney by ^{99m}Tc-cysteine which is not possible by current agents ^{99m}Tc DMSA [2] or ^{99m}Tc GHA [3] where the radioactivity spills over other organs too. [4] shows a drawing for organ identification for scintigraphic images.

herent with any ultramodern scientific discipline, progress of radioimaging had been quite impressive. At present 67 journals have made their appearance in citation report under 'Radiology-Nuclear Medicine Section', topped by *Journal of Nuclear Medicine* showing highest impact of this discipline over other radiological methods. This is not surprising since nuclear imaging gives a picture of organ dynamics whereas other radiological methods (X-ray, CAT-scan, etc.) can only show the anatomy of the system. Commercial importance of ^{99m}Tc-based radiopharmaceuticals has been mentioned earlier.

Anticipating a deep scientific and commercial impact of this new discipline in the medical field, Dr Somenath Banerjee started working in this area in 1981, who even in those early years of this discipline acquired 5-6 years of research experience from abroad in this field. At that time, renal transplant operation in India was steadily rising, and for evaluating the success of such operation, measurement of renal function was necessary. This is most efficiently evaluated by dynamic renal imaging. However, the radiopharmaceutical (^{99m}Tc-DTPA) which was used for renal imaging was old (1972) and had an inefficient (glomerular filtration) pathway of clearance (Fig.2) producing poor image quality. ^{131}I- orthoiodohippurate, an agent that clears by renal tubular secretion, was quite efficient physiologically but its use for humans was discouraged because of its hazardous radiolable. The development of a ^{99m}Tc chelate which could mimic hippurate's receptor binding properties became a research area of high priority.

Since 1981, several ^{99m}Tc-based renal tubular radiopharmaceuticals have been reported, but until now none of them has matched the renal specificity of the standard (hippurate). However, all these chelates had one or more amino acid residue. So at IICB, a study was undertaken to evaluate the physiological properties of ^{99m}Tc-amino acid chelate. This led to the emergence of ^{99m}Tc-cystine with which a study of renal tubular function and renal morphology could be done in one step. After successful evaluation in animal model, the compound was tried on normal human volunteers and renal patients, in collaboration with Sanjay Gandhi Post Graduate Institute for Medical Research, Lucknow, with the same exciting results (Fig.2). For further clinical studies in different medical centres in India, the compound must have been available in kit forms. Since the radiopharmaceutical industry (BRIT) has a considerable experience in ^{99m}Tc-kit formulation, the institute saught their help in this area in terms of a joint project.

Most of the radiotracers used in biological research come with their radiolabels already put on them. Tc having a ultrashort half life can not be made available that way. The ligand and the label, therefore, come separately, the former as a kit prepared with some other chemicals (stannous chloride, buffer, etc.) lyophilized together. The chemicals in the kit are designed in such a way that on addition of the label (^{99m}Tc), the desired radiopharmaceutical is produced quantitatively and is

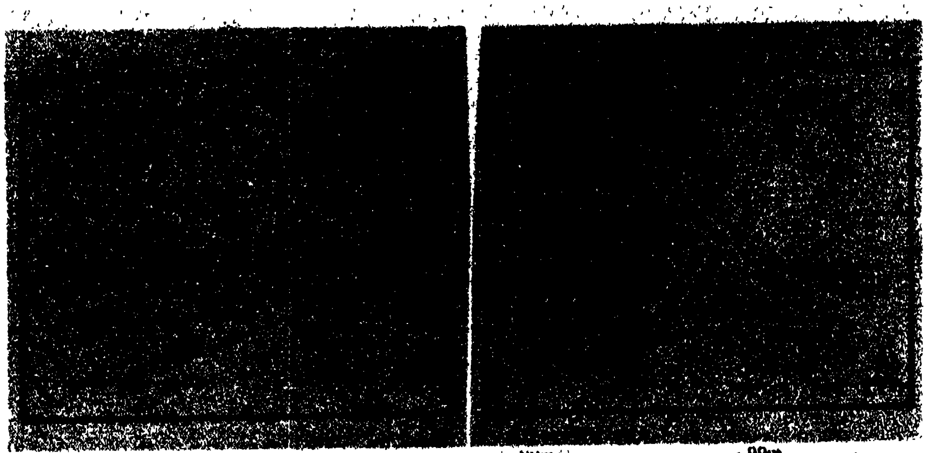


Fig.2— Study of a renal transplant patient with ^{99m}Tc-DTPA (left) and ^{99m}Tc cystine (right). In the latter study the shape of kidney is visualized better.

ready for injection to patients shortly thereafter. However, this is a complex technology and so far it is not equally successful for all chelating groups. Specially, the chelation with Tc-S- combinations are frequently met with limited success, which is a problem for formulating a Tc-cysteine kit. On the other hand, the technology of kit formulation for iminodiacetic acid (IDA) ligand are well developed. Therefore, it was thought that if a cysteine analogue could be made available with IDA group, it was more likely to be successful in kit formulation.

Renal radiopharmaceutical research in IICB at this stage was bifurcated into two main streams : (a) Development of ^{99m}Tc chelate for renal tubular secretion based on IDA ligands (supported by DBT); and (b) Structural investigation of Tc- cystine for better understanding of the problem of Tc-S kit formulation (supported by DST).

After several years of intensive investigation in IDA derivatives, finally the desired ligand, i.e. dimethyl ester of diethylene triamine pentaacetic acid (DMDTPA) was identified, which on ^{99m}Tc chelation afforded an agent exhibiting profuse renal excretion characteristic of elimination through renal tubular pathway.

An extensive comparative study of this compound was undertaken in mice, rat, rabbit, dog and monkey models with ^{99m}Tc- mercaptoacetyl-glycylglycylglycine (^{99m}Tc MAG$_3$), using dissection and scintigraphic methods. In all the animal species, ^{99m}Tc- DMDTPA showed better renal specificity than ^{99m}Tc-MAG$_3$ with similar renal kinetics. Study in dog model showed that while using ^{99m}Tc-DMDTPA only the renal system comes in the view with ^{99m}Tc-MAG$_3$, in addition to above, an appreciable amount of radioactivity unnecessarily goes to liver, thus decreasing the specificity of this agent with respect to ^{99m}Tc-DMDTPA (Fig.3). In both the sets the rate of disappearance of radioactivity from kidney appears in the curve (d) which shows similar slopes thus showing both the drugs clear from kidney with equal efficiency.

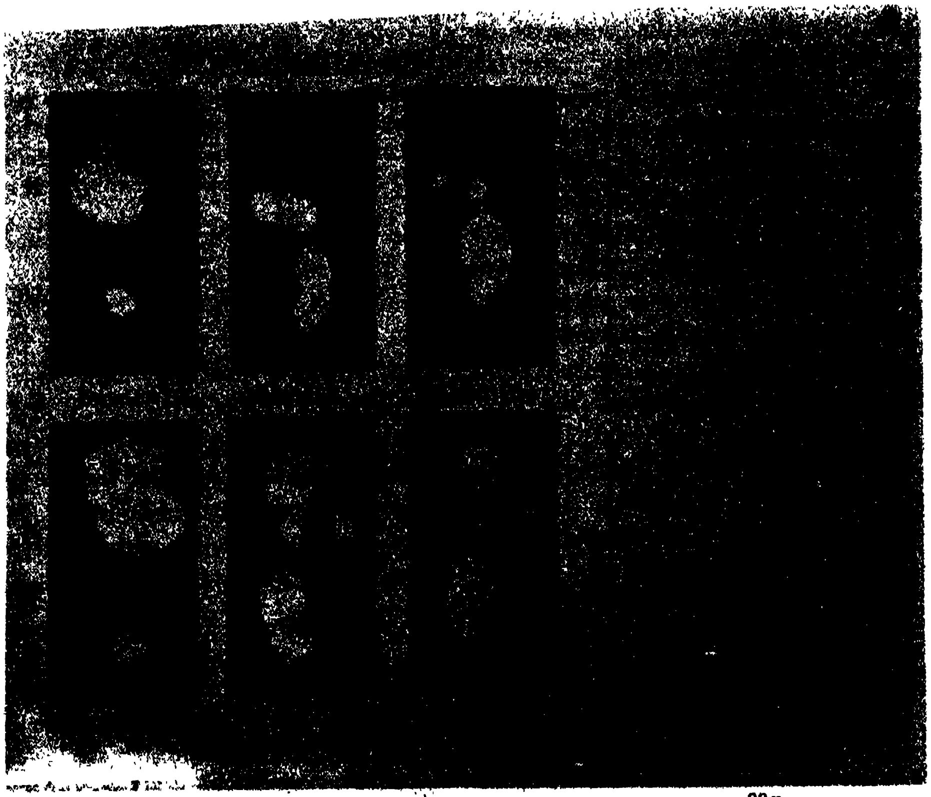


Fig.3— γ-Camera photograph showing kidney function in a dog with [1] ^{99m}Tc-DMDTPA, and [2] ^{99m}Tc-MAG$_3$. Complete specificity towards renal system is observed with [1] and not with [2] where liver is also visualized. The similar slope of the curves for [1] and [2] indicate their similar affinity towards renal cellular transport system. Also, the proposed compound is much inexpensive in comparison with [2]. L = liver; K = kidney; U = urinary bladder.

^{99m}Tc-MAG$_3$, the renal tubular radiopharmaceutical developed in USA is at present marketed all over the world by Mallinckrodt, USA. But, because the starting material (glycylglycylglycine) is expensive and further chemical manipulation is needed to produce the ligand, the price of ^{99m}Tc-MAG$_3$ is exhorbitantly high. On the other hand, dimethyl DTPA can be easily produced from inexpensive and indigenously available DTPA, by simple esterification. Therefore, the developed drug has a better target specificity and can be made available at lower cost in comparison to the current drug available internationally.

A patent application for ^{99m}Tc-DMDTPA was filed, and through a collaborative programme with the industry (BRIT), duly approved by appropriate authorities, a commercial kit was produced which was found to give satisfactory performance. Christian Medical College, Vellore, agreed to compare the efficacy of ^{99m}Tc-DMDTPA and ^{99m}Tc-MAG$_3$ on renal patients, and a joint application was made to Radiopharmaceutical Committee and Nuclear Medicine Committee to clear this drug for clinical trial.

Of all the radiopharmaceuticals sold by BRIT, the agent used for hepatobiliary function studies, (^{99m}Tc-Mebrofenin) [2] is most expensive. This was developed in USA and is available in India since around 1990 through BRIT. To develop a more affordable agent in this area, IICB began a study with fifty potential compounds under an ICMR Project from which emerged a compound ^{99m}Tc-β-Naphthofenin [1]. Comparative scintiphoto and hepatocellular kinetics of this compound with compound [2] in rabbit is shown in Fig.4. The results indicate that the developed compound [1] is as efficient as [2] in hepatobiliary excretory properties. Moreover, in the preparation of β-Naphthofenin, the expensive starting material, 2,4,6-trimethyl-3- bromoaniline required for the synthesis of mebrofenin is replaced by cheap and indigenously available β-naphthol thus making this agent more affordable to Indian patients.

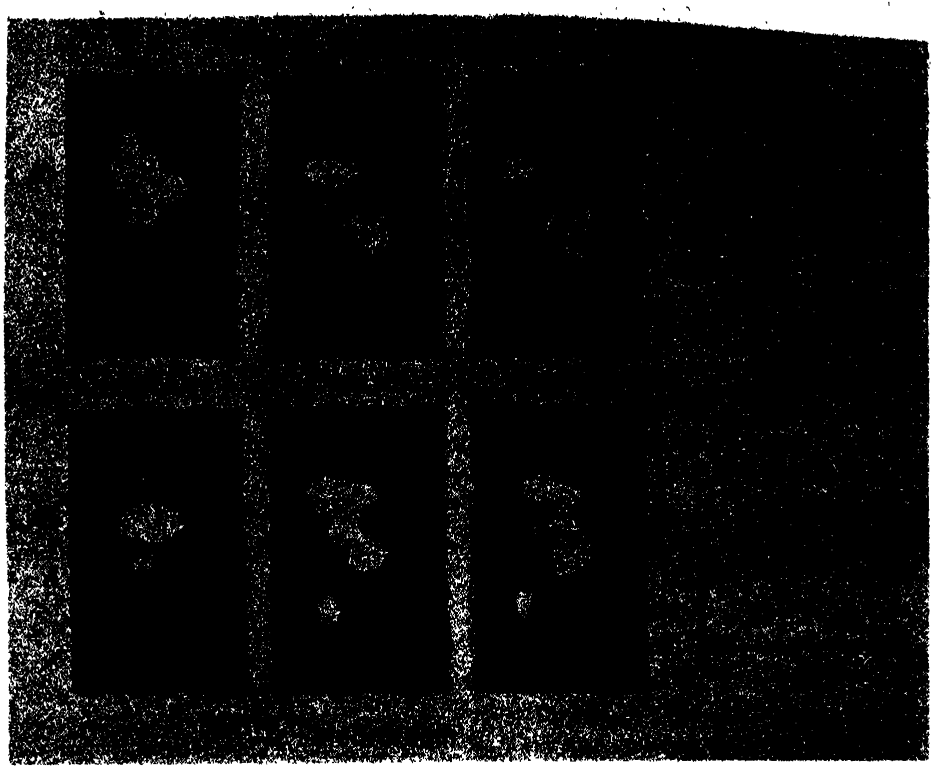


Fig. 4— γ-Camera photograph showing liver function in a rabbit with [1] ^{99m}Tc-β-Naphthofenin, and [2] ^{99m}Tc-Mebrofenin. In spite of earlier delineation of gall bladder as observed in [1] compared to that of [2], their rate of disappearance from liver is same, indicating a similar affinity of both the compounds towards hepatocellular transport system. [1] is therefore equally informative as [2] but cheaper to produce. L = liver; G = gall bladder; I = intestine.

Apart from all these commercial developments, basic research to solve the problem of Tc-S chelation was undertaken side by side. ^{99m}Tc-cystine was quite successful from clinical view point but could not be subjected to kit formulation because of the extreme insolubility of the ligand in physiological PH. After several years of extensive research supported by DAE, Tc-cystine and Re-cystine were isolated in mg quantity and subjected to X-ray crystallography. It was observed that the Tc-cystine molecule consists of two bidentate cysteine molecules attached to oxo- technetium moiety. The chelate could only be produced from cystine and not from cysteine itself and such attempt always led to polymerization. A photomicrograph of Tc-cysteine chelate synthesized and characterized by X-ray crystallography is shown in Fig.5.

The ORTEP diagram (Fig.1) clearly explains the renal properties of ^{99m}Tc-cysteine [2] as hippurate [1] analogue. Studies involving a large number of hippurate derivative indicated that proximity, i.e. O$_1$-O$_3$ distance; and orientation, i.e. dihedral angle O$_3$-C$_9$-C$_7$-O$_1$ of oxo and carboxylate grouping are

Fig. 5— Photomicrograph of Tc-cysteine chelate synthesized and characterized by X-ray crystallography. First Tc-chelate was characterized in 1978.

the main determinants for interaction with the renal tubular cell surface transport protein. The distance can have values 3-8 Å because of the repetitive sites of binding in the protein molecule and O_1-O_3 distance of ^{99m}Tc cysteine falls in this range (5.2 Å). Also, the above dihedral angle for hippurate and ^{99m}Tc cysteine are 46° and 42° respectively, which are close enough for similar biological interaction resulting in rapid renal excretion in both the cases.

Moreover, Tc-O_4 bond length (2.15 Å) is unusually long in comparison to normal Tc-O bond length (1.99 Å). This polarizes the Tc centre and generates its affinity for soft electron rich centre like sulphydryl moiety resembling the biological property of organomercurials. Therefore, once inside the renal tubular cell it is not unusual to assume that an appreciable amount of ^{99m}Tc-cysteine will bind with sulphydryl rich lisozyme causing its fixation in kidneys. The investment in developing above sophistication in drug design is paid off by the accuracy in tissue targetting as shown in Fig.1, compared to other two current agents. ^{99m}Tc-cysteine targets accurately the renal system to show only kidney and bladder whereas ^{99m}Tc-DMSA and ^{99m}Tc-GHA lack that specificity and get spilled in other organs too.

The successful design of ^{99m}Tc cysteine and its accurate accumulation in the expected target indicate that this agent can map changes in sulphydryl concentration in human organ system under different pathological conditions. As for example, during myocardial infarction because of the cell death and resultant release of lysozyme there is an increase of sulphydryl concentration around the infarcted area which can be easily picked up by the ^{99m}Tc-cysteine, making this agent a useful one for diagnosis of myocardial infarction also. It is possible that ^{99m}Tc-cysteine could be used for other diagnostic purposes where a change of concentration of sulphydryl group occurs. These possibilities are being investigated at present.

All these encouraging results and exciting future possibilities have led IICB to put even greater impetus to develop a kit for ^{99m}Tc-cysteine. Successful elucidation of the chemical structure of the chelate furnish some definite ideas to achieve the same and the institute hopes to develop a workable method in the near future. A DST project has been recently sanctioned to support this work.

Nuclear Medicine though appeared late in medical field, its importance has been quickly recognized, and it is anticipated that in near future every health care centre of this country will consider Nuclear Medicine facility indispensable. However, to make this discipline more attractive the radiopharmaceuticals have to be more target specific and for such drug designing, basic knowledge in technetium chelate chemistry is absolutely essential. IICB with its tradition of excellence in basic science therefore becomes an ideal place for developing this discipline. ☐

Mosquito Repellents based on Natural Products

IN India, around 40 million people suffer every year from mosquito-born diseases like malaria, filariasis, Japanese encephalitis, cholera, typhoid, yellow fever and dengue. At the same time, the mounting concern regarding harmful effects of chemical insecticides has led to restrictions/ban on the use of a good number of these. The efforts at present are therefore directed towards the development of eco-

Scented insect repellent liquid and mosquito repellent lotion (left); and Mosquito repellent-cum-room freshner spray developed by CIMAP.

friendly insecticides that pose minimum risk to man and the environment. As a result, naturally known botanical substances have gained tremendous edge over their synthetic counterparts to control insects. Further, the botanical insecticides are non-persistent, i.e. they break down into harmless compounds rapidly after application, have less mammalian toxicity and can be handled safely. The Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, has recently developed some formulations in the form of a scented insect repellent liquid, a mosquito repellent lotion and an insect repellent-cum-room freshener spray.

Scented Insect-repellent Liquid and Mosquito-repellent Lotion

About three drops of the scented insect-repellent formulation are to be added in 5-6 litres of water and mopped on the floor. The repellency has been observed to be effective for 6-8 hours against mosquitoes and house flies. Similarly, about three drops of the mosquito-repellent lotion have been found to be effective for eight hours during night when rubbed on the exposed parts of the body.

Field trials of these formulations carried out in rural and urban areas have given 95% success results. The formulae are being patented before releasing these for commercialization.

Mosquito-repellent-cum-Room Freshner Spray

The product is based on approved natural repellents that possess low mammalian toxicity and medicinal, insecticidal, insect repellent, nematicidal and disinfectant properties. It is envisaged that the product will be more bio- and eco-friendly than the currently marketed low-priced insect repellents in the form of coils, mats and liquid. Moreover, it possesses a pleasant odour due to the presence of aromatic essential oils that will attract its use as a room freshener too. On the basis of a survey conducted by CIMAP, 56% of those sampled in the age group 17-71 have recommended the use of the product both as repellent and room freshner while 35% found it suitable as repellent only. On an average, the formulation is observed to be lasting up to 5-7h with a nozzle spray of 4-5 times at a stretch. The product has been found to be safe for domestic use against mosquitoes, house flies and even ants. Its formulation is being patented in India, and will be commercialized soon. ☐

Demonstration of menthol mint variety 'Himalaya'

UNDER the U.P.Government's Ambedkar Vishesh Rojgar Yojana (AVRY), the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, organized an 'on-farm' demonstration of the newly developed, high yielding, disease-resistant variety 'Himalaya' of the menthol mint (*Mentha arvensis*) in the fields of 60

Dr R.A. Mashelkar, Director General, CSIR, visiting a field of menthol mint cv. Himalaya, of a beneficiary farmer of U.P. Government's 'Ambedkar Vishesh Rojgar Yojna' being implemented by CIMAP. Standing on the left of Dr Mashelkar is Dr Sushil Kumar, Director, CIMAP.

selected farmers of 11 villages of Lucknow, Sitapur and Udhamsing Nagar districts of Uttar Pradesh during 1996-97.

Dr R.A. Mashelkar, Director General, CSIR and Secretary, Department of Scientific and Industrial Research, visited one such village, Jainabad, falling under the block Bakshi-ka-Talab of Lucknow district on 2 April 1997. He went round the fields of the beneficiaries of the 'Ambedkar Vishesh Rozgar Yojna' and expressed his happiness over the better performance of the improved mint variety released by CIMAP, in comparison to that of the prevailing variety under cultivation.

During the second year (1997-98) of the project, 25 additional farmers of Badaun and Moradabad districts would be included in this project. The project aims to create 425 direct and 2550 indirect job opportunities during the period of two years of the project. ☐

[illegible] dimensional [illegible] model.

The project formally [illegible] on 5 March 1997 and is [illegible] to be completed in 2[illegible]

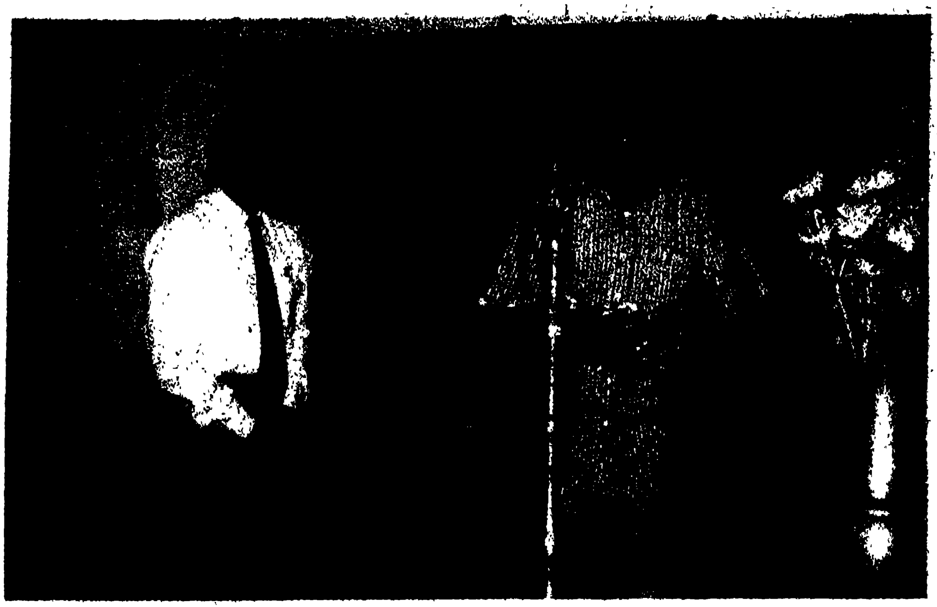
Emerging Trends in Scientific Computing and Mathematical Modelling

A six-day national workshop on 'Emerging Trends in Scientific Computing and Mathematical Modelling' was held at the Indian Institute of Chemical Technology (IICT), Hyderabad, from 17 to 22 February 1997.

The inaugural session was presided over by Dr K.V. Raghavan, Director, IICT. Maj Gen. R.K. Bagga, former Director, Computer & Information Centre, DRDL, inaugurated the workshop and also delivered a keynote speech on high-performance computing and recent trends in information technology. The workshop was attended by 22 participants including scientists, engineers, professors and managers representing CSIR labs, ICMR units, Defence, university and industry sectors.

In the week-long programme, both software and computational aspects were discussed, covering a wide range of techniques, viz. optimization, multivariate statistics, parameter estimation, artificial neural nets, simulated annealing, fuzzy systems; computer-aided studies in analytical chemistry and molecular modelling. Training was also imparted in MS Word and C++ programming with object orientation. A total of 21 lecture sessions and nine PC-laboratory sessions were arranged.

The workshop was an instant success in so far as achieving its objective in training and educating the participants in the emerging trends in computing and IT and their applications in chemical sciences as well as other disciplines. There was an overwhelming opinion that such workshops should be repeated every year. Also several participating or-



Dr K.V. Raghavan, Director, IICT, lighting the lamp during inaugural session of the workshop on 'Emerging Trends in Scientific Computing and Mathematical Modelling. Maj. Gen. R.K Bagga, former Director, Computer and Information Centre, DRDL, who inaugurated the workshop in also seen in the picture

ganizations hinted at the possibility of useful collaborative research programmes; sponsored work or consultancy assignments.

The entire programme was conducted by the staff of Computer Centre of IICT with some assistance from guest faculty. Dr P.J. Reddy, Head, Computer Centre, was the convener of the workshop. Proceedings of the workshop have been brought in two volumes (Lectures & Laboratory) which also contain some of the recent results of R&D work carried out at IICT, in this area. ❑

ISO - 9001 Awareness Programme for CSIR Laboratories at CFRI

A two-day ISO-9001 Awareness Programme was organized by the Central Fuel Research Institute (CFRI), Dhanbad, at CFRI on 20 - 21 February 1997. Twenty-five scientists from eleven CSIR laboratories participated in this programme with the aim to attain total quality management in their respective laboratories.

In his opening remarks, Dr H.R. Bhojwani, Science Secretary and Head, R&D Planning and Business Development Division, CSIR, said that CSIR's objective is to become a 'Total Quality Organization' which can provide good service that go well beyond the expectations of both the external and internal customers. CSIR is not producing anything physically but creating new ideas and producing utilizable knowledge. To CSIR, science is for the industry. In its *Vision - 2001* document, CSIR has laid emphasis on scientific industrial research and not on scientific research alone. Dr Bhojwani stressed that while providing a variety of services to the industry, CSIR will strive to fulfil the expectations of industry and other users. CSIR will set up a mechanism to evaluate the customer's satisfaction and ISO-9001 is a step towards total quality management. He hoped that CFRI, the first laboratory in CSIR to be accredited with ISO-9001 Certification, will lead other CSIR laboratories in that direction.

Dr H.R. Bhojwani, Science Secretary and Head, Research, Planning and Business Development Division of CSIR, delivering opening remarks at the workshop on ISO-9001 Awareness Programme for CSIR Laboratories

In his welcome address, Dr K.S. Narasimhan, Director, CFRI, said that in the present day context, quality is the most important factor. ISO standard means incremental improvement every day. To attain total quality, goals of an organization have to be identified and the target is to be set up. Later on, planned management is to be enforced to achieve the target. ISO-9000 series is a set of standards which provide framework for Quality Management System to be pursued in each and every step, he added.

Participants were given lectures by the experts from CFRI and MECON and explained the procedure followed by CFRI for ISO-9001.

Shri P.K. Sen of MECON awarded certificates to the participants.

Shri P.K. Sen of MECON awarding certificate to a participant of Workshop on ISO-9001 Awareness Programme for CSIR laboratories, while Dr K.S. Narasimhan, Director, CFRI (sitting) and Dr S.R. Gun, Head, Business Development Group (second from right) look on

Dr R.A. Mashelkar congratulates CFRI

Visiting CFRI on 22 March, Dr R.A. Mashelkar, Director General, CSIR, congratulated CFRI for acquiring ISO 9001 certification first among the CSIR laboratories. He said that this is a rare feat in the CSIR family and reflects the transparency and the mutual trust between the management and the workers of the institute. He added that CSIR in *Vision 2001* has emphasized quality conscious management and CFRI is the first among CSIR laboratories to supplement it with its own strategies for the future. ISO 9001 is a step towards participation and dynamism for Total Quality Management.

He also congratulated CFRI for crossing the target it set for external cash flow and expressed the hope that CFRI will achieve higher target in the next year.

Dr Mashelkar informed that CSIR has received an amount of Rs 500 million from the Central Government towards its modernization.

He also released a souvenir of the spring festival organized by CFRI Club.

Earlier, welcoming Dr Mashelkar, Dr Narasimhan, Director, CFRI, expressed that his institute would continue to make all efforts to win more and more laurels for CSIR. ☐

Dr R.A. Mashelkar, Director General, CSIR and Dr K.S. Narasimhan, Director, CFRI, in discussion with Project Leaders of the institute

NAL Guest Lecture

Systems Engineering — Aircraft

Mr Paul Gartz, Senior Principal Engineer from Boeing, delivered the NAL Guest Lecture on 'Systems Engineering - Aircraft', in the Systems Auditorium of National Aerospace Laboratories (NAL), Bangalore, on 11 April 1997. Discussing 'proven processes' for developing modern aircraft systems, he essentially conveyed the following messages:

- Aircraft systems are now more complex, capable and integrated;
- Business value considerations drive everything;
- Decision margins for error have tightened; and
- The speed of everything is increasing.

Equally enjoyable was Mr Gartz's compelling narration of the history of Boeing: the story began in 1916 with Bill Boeing telling himself, "I think I can build a better plane" (than presumably what the Wright Brothers built). Mr Gartz even showed the photo of the building where it all began (now a museum). The audio-visual show continued with photos of changing airplane configurations: B-17, B-47, Dash 80 (to later evolve into the 707), the best-selling 727 and 737, the awesome 747, 757 and 767 with their common flight deck, and finally the $5 billion project leading to the Boeing 777 ("triple seven").

Mr Gartz's description of the 777 suggests that he (and everyone else at Boeing) is absolutely delighted with the way the plane has shaped up. He talked of the plane's high and large (and yet "unbelievably quiet") engines, about the 777's glass cockpit displays ("display areas are comparable to real estate in terms of their value"), about the entertainment network aboard the airplane ("500 films to choose from on your personalized display monitor; or the opportunity to surf the Internet as you fly from KL to NY") and about how they built one full 777 "simply to break it down completely"! ❑

SEMINARS

Modern Technologies and Rural Development

A National Seminar on 'Modern Technologies and Rural Development' was organized by the National Institute of Science, Technology and Development Studies (NISTADS), New Delhi, during 27-29 March 1997, at Sir Chhotu Ram Rural Technology Institute, Kanjhawala (Outer Delhi).

The seminar was aimed at providing a platform for mutual exchange of ideas among the scientists who are willing to take technologies from 'Lab to field', and the users in the rural settings.

A distinctive feature of the seminar was that its entire proceedings were conducted in the local dialect. About 150 scientists, social reformers, progressive farmers, technicians and artisans participated in the seminar.

The seminar was inaugurated by the Union Minister of Rural Areas and Employment Shri Kinjarapu Yerrannaidu. Speaking in Hindi, he laid emphasis on the important role that Science and Technology can play in rural development in India. He pointed out that technological developments being achieved in various national laboratories were meaningless unless their benefits reached the common man in the rural sector.

Outlining the aims of the seminar, Dr Ashok Jain, Director, NISTADS, observed that the researchers engaged in developing technologies in different national laboratories are not fully aware of the techniques and methodologies being used by the rural people and are therefore ignorant about the problems being faced by them. This gap has generated the need for a meaningful dialogue between these two groups. Another objective of the seminar was to identify such institutes which could serve as a bridge between research laboratories and the rural sector. He complimented Sir Chhotu Ram Educational Trust for taking the lead in this direction.

The convener of the seminar Shri S.S. Solanki, Scientist, NISTADS, who himself is associated with several rural development programmes, proposed a vote of thanks.

The inaugural session was followed by six technical sessions: (1) Making foodgrains and other agricul-

Seated on the dais during the national seminar on 'Modern Technologies and Rural Development' (from left) are: Shri Hoshiar Singh, Dr Ashok Jain, Shri Kinjarapu Yerrannaidu, Ch. Priya Vart, Ch. Sukbir Singh Dalal and Shri S.S. Solanki tural produce consumer- friendly, (2) Dissemination of modern rural technologies, (3) Agricultural machinery and implements, (4) Technologies related to artisans in villages and districts, (5) Rural housing and related technologies, and (6) Rural technology regulations and policies. A total of 55 presentations were made. A large number of villagers from Kanjhawala and adjacent areas attended the seminar and took active part in the deliberations. Opportunity was also provided to them to have an on-the-spot discussion about their problems with the scientists.

Recommendations

The following recommendations were adopted at the final joint session attended by scientists, social reformers, progressive farmers, senior villagers, officers of various government departments/ministries and non-government organizations (NGO's):

1. Data should be collected and recorded about the social, economic, technical and educational status of rural people at district/sector level for the entire country. Plans for the development of each district or sector should be formulated keeping these data in view.

At least five persons who are deeply associated with the rural environment and are fully aware of rural problems should be associated with the formulation of Development Plans which would make workers in agricultural and related fields self-reliant. Rural professionals engaged in agriculture and allied works would have to be organized, and the commercially viable and inter related industries as well as professional houses established based on recently developed rural technologies. And the two would have to be linked. Based on these Development Plans some 'Model Plans' would have to be outlined for helping the NGO's in their activities.

2. Demonstration-cum-extension programmes in respect of rural technologies matching socio-economic conditions of the concerned areas, educational and technical skills of the people and the types of raw materials available in the areas should be formulated and propagated district- or sector-wise. The main issues that need to be addressed in this respect include identification of persons, NGOs and/or social institutes which can generate interest about such technologies among the rural people and can also play an active role in the implementation of programmes.

It was also recommended that Sir Chhotu Ram Rural Technology Institute, Kanjhawala, Delhi, should be assigned the responsibility for establishing the first such 'Demonstration Centre'.

3. Artisans, craftsmen and technicians of the area should be drafted for imparting training in new technologies. In special cases, this task should be assigned to persons engaged in the dissemination and adoption of new technologies. This would help in utilizing and nurturing local talent on one hand and permit imparting of training in local language and local environment on the other.

4. In popularization of rural technologies and programmes relating to rural development, mass media (radio/TV/news papers/magazines, etc.) can play an important role. For this, government should enact suitable legislation directing the electronic and print media to include stories on rural technologies regularly in their daily programmes.

5. Every year government starts several industrial training institutes in and around villages for imparting technical education to the rural youth. But in reality, this aim is not being fulfilled. Instead of the rural youth, children from nearby urban and semi-urban areas get admission in these institutes, since they are able to secure more marks than rural children because of better facilities available to the former. It was recommended that the technical institutes opened by the government for catering primarily to rural areas should admit students from rural areas only. This would be a sure way of imparting the requisite skill and capabilities among rural youth to make them a viable component of rural development programmes.

6. Seminars such as the present one should be organized regularly in different districts of the country, in the local dialect, so that the local expertise, experiences and aspirations could be effectively pooled and utilized. Emphasis at these seminars should be on the dissemination of information about selected rural technologies specific to the concerned area rather than on the presentation of highly technical papers, as is usually done. The aim should be to foster a close contact between researchers and rural users, so that both could draw mutual benefit. Discussion on any technology should, as far as possible, be supported by its practical demonstration, so as to make a proper impact. ☐

National Science Day

TWENTY-EIGHT February is observed throughout the country as National Science Day in commemoration of the discovery of Raman Effect. Many CSIR labs celebrate this day by holding quiz, essay, elocution and drawing competitions for students, arranging special lectures and film shows on scientific themes, etc. Highlights of celebrations of some of the laboratories this year are presented here:

Central Electrochemical Research Institute (CECRI), Karaikudi

The institute celebrated the occasion jointly with the Swedeshi Science Movement (SSM). Smt. M.P. Nirmala, District Collector, was the Chief Guest. Dr A.S. Lakshmanan, Dy Director, CECRI, delivered a keynote address on Raman's Findings. Dr V.S. Muralidharan, Scientist, CECRI and Vice President, SSM; Dr P.L. Sabarathinam, Registrar, Annamalai University and Vice President, SSM, presided over the function.

Quiz, essay, eloculation and drawing competitions were conducted for school students at Kottaiyur (for Devakottai zone). Sivagangai, Arantangi, Pudukkottai, Paramakkudi and Ramanathapuram during 1-5 February. The finals (inter district) were held on 22 February at CECRI. The winners at the district level were given prizes, and at the interdistrict level, rolling shields. Sir C.V. Raman and Dr K.S.G. Doss memorial shields were awarded to Oxford Matric School, Sivaganga; Dr S. Chandrasekar memorial shield to St. Arulanandhar Hr. Secy. School, Oriyur; Dr Devanathan memorial shield to Muslim Hr. Secy. School. Abiramans; and Dr Thavathiru Adigalar memorial shield to St. Justin Girls Hr. Secy. School, Sivaganga.

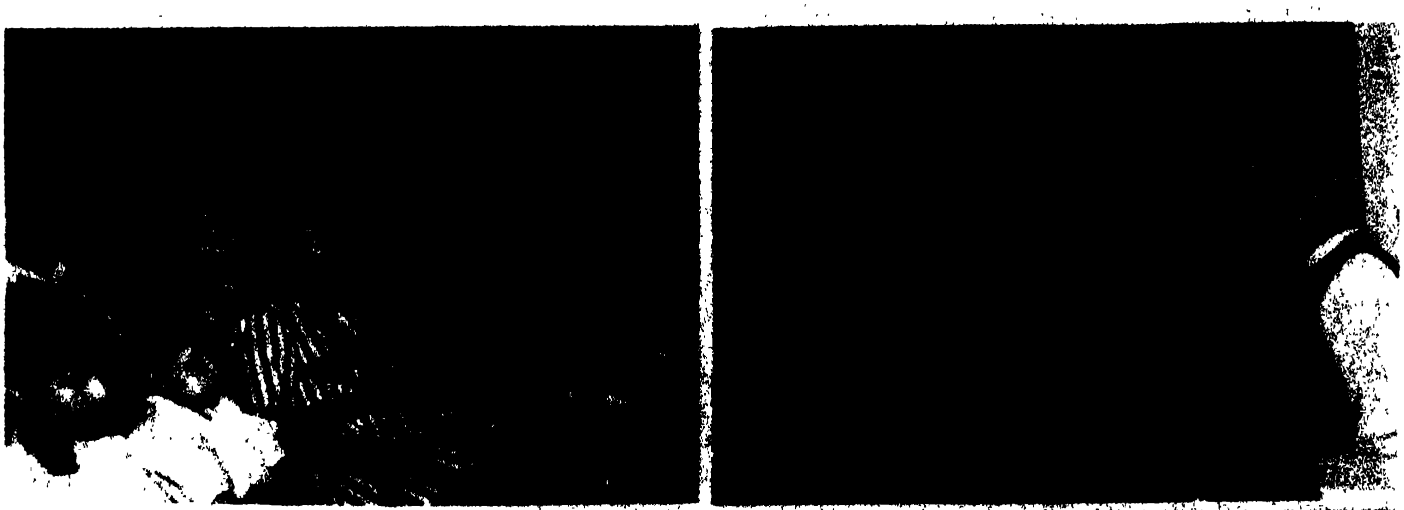
Central Fuel Research Institute (CFRI), Dhanbad

Prof. R.P. Singh, ex-Director of BIT, Sindri, was the Chief Guest and delivered a lecture on 'Some Aspects of Scientific Awareness for Tackling Socio-economic Problems in Indian Context'. In this lecture, he discussed some basic problems regarding material resources, population, food and energy. Elaborating on resource depletion owing to rapid industrialization and the consequent ecological imbalance, he pointed out that this kind of irreversible change may ultimately lead to a catastrophe and exhorted the scientific community to help avoid this. Earlier, Dr K.S. Narasimhan, Director, CFRI, apprised the audience about the significance of the day and also introduced the Chief Guest. Dr R.N. Bhattacharya, Scientist, CFRI, spoke on the 'Raman Effect'. Shri Samir Sen proposed a vote of thanks.

CFRI also conducted debate and art competitions for the students; the theme was 'India of Our Dreams'.

Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavanagar

Dr Mohan Bhadbhade of the institute gave a talk on 'Life of Sir C.V. Raman' on 24 February. A one-day workshop on Molecular Structure Determination by Spectroscopy and Diffraction Methods was organized on 25 February. On 26th, the Scientists of the institute delivered talks



Dr R.P. Singh, ex-Director of BIT, Sindri, delivering a lecture on National Science Day at CFRI on CSMCRI R&D activities, at five schools. A meet between the scientists and farmers was held on 27th, which paid special attention to cultivation of jojoba and jetropha.

On 28 February, Prof. R.V. Mehta, Head, Department of Physics, Bhavnagar University, gave a talk on Sir C.V. Raman. Prof. Vidyut Joshi, Vice Chancellor of Bhavnagar University, delivered the valedictory address in which he stressed the need to replace traditionalism by scientific approach. He also gave prizes to the winners of the essay, quiz and general knowledge competitions organized by the institute during 21-28 February.

Central Scientific Instruments Organisation (CSIO), Chandigarh

A lecture by Dr N.A. Narasimham, ex-Head, Spectroscopy Division, BARC, Mumbai, was the main feature of the at function at CSIO. He spoke on the role of spectroscopy in astrophysics. Laboratory studies of spectra of atoms and molecules enable their identification in astronomical sources. Unidentified spectra observed first in comets nebulac and interstellis spaces provide an incentive to obtain such species under laboratory conditions. Extra terristrial life can thus be predicted from spectra.

Earlier, Director, CSIO, welcomed the guests and highlighted the significance of the Day. He also distributed the prizes amongst the winners of the essay writing competition.

The institute observed Open Day and also arranged an essay competition for school going childern of the staff. Prizes were given to the winners.

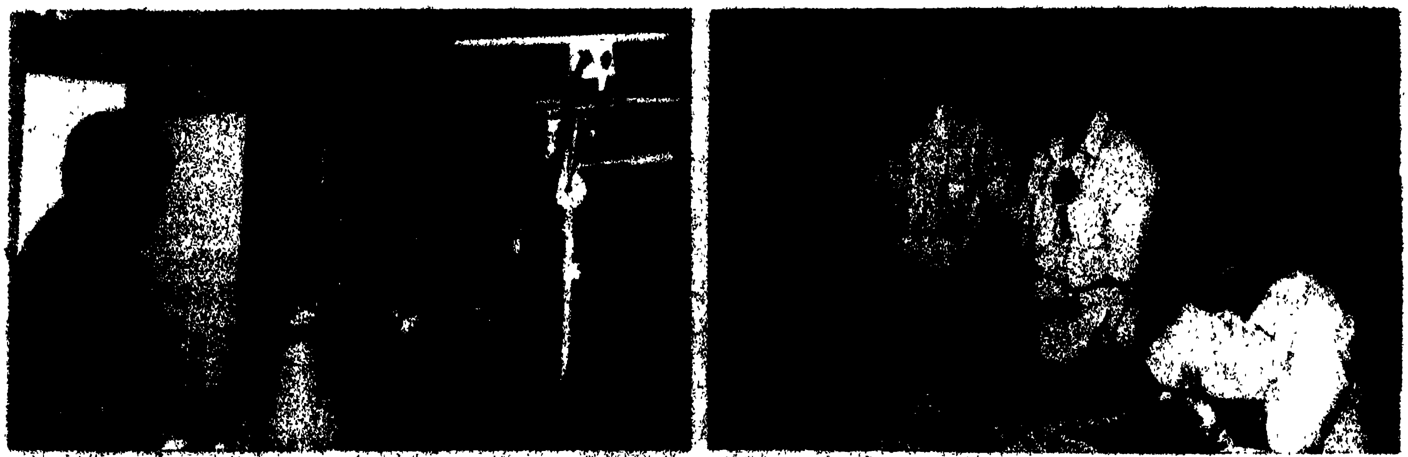
Indian Institute of Chemical Biology (IICB), Calcutta

The programme was organized joinly by Science Association of Bengal and IICB, in collaboration with Jadavpur University and Indian Association for the Cultivation of Science. Dr Jyotirmoy Das, Director, IICB, welcomed the guests. He stressed the need of dissemination of Science & Technology knowledge among common man and school children. Dr Amit Chakraborty, Director, Akashvani, Calcutta Centre, inaugurated the function. He spoke on the significance of the National Science Day.

A seminar on traditional and modern Science & Technology was organized in which Shri Sunil Banerjee of Synergy Consultants spoke on Traditional Science; Dr N.C. Dutta of Calcutta University, on Ecology & Environment; Dr Sibabrata Mukhopadhyaya of IICB, on Indian Medicinal Plants; Prof. R.K. Mukhopadhyay of Jadavpur University, on Traditional Science and Its Philosophical Aspects; Shri Sanjoy Saha of Regional Computer Center, on Information Technology; Dr R. Debnath of CGCRI, on Glass Technology; and Dr R.C. Basu of Zoological Survey of India, on Ecology.

About 300 students from 16 different institutions participated. Quiz, debate and essay contests were also organized.

Jnan Ghosh memorial lectures were delivered by Dr Santanu Banerjee and Shri P.C. Basu. Prof. Suboda C. Som, Vice-chancellor, Jadavpur University, presided over the valedictory function and gave away prizes and mementoes. Shri S. Roy Chowdhury, Coordinator for the programmes, presented a vote of thanks.



School children visiting CSIO on the occasion of National Science Day (NSD) celebrations, and Dr Jyotirmoy Das, Director, IICB, lighting the lamp during NSD celebrations at IICB, as Dr A. Chakraborty and Shri S.R. Mridha look on

Indian Institute of Chemical Technology (IICT) and Central Cellular & Molecular Biology (CCMB), Hyderabad

IICT and CCMB jointly conducted the following programmes: Popular lecture on Seeds of Change by Prof. H.Y. Mohan Rao, University of Delhi, Delhi; a debate on Basic Research Relevant to India for research scholars of IICT and CCMB; Essay competition for school children, on An Ideal Science Education System for Schools; and Screening of a science film. Prizes were given to the winners of the debate and essay competitions.

National Aerospace Laboratories (NAL), Bangalore.

Prof. R. Narasimha gave a lecture on 'The Aerodynamics of Weather'. The lecture made the important point that the aerodynamics of weather is many times more complex than the aerodynamics of an aircraft ("Thank God, I am not a meteorologist", C.V. Raman is said to have remarked). To qualify his argument, Prof. Narasimha pointed out that "In aeronautics, you only have project schedules to beat; in weather prediction you must beat nature!" "Again in aeronautics you ask questions like 'given wind, what forces?' while in meteorology you seek answers to 'given forces, what wind?"

He gave rich tributes to Sir C.V. Raman and his students; K.R. Ramanathan ("who did extraordinary things in meteorology"), Ramdas (and his remarkable theory of lifted temperature minimum on calm, clear nights) and Bannerji. There was the story about how von Karman advised Charney to "try meteorology since I have solved all the problems of aeronautics". There was the mandatory Narasimha reference to something wise written in Sanskrit (confirming, in this instance, the enduring Indian obsession with rain). And there were two utterly delightful cartoons on the problems involved in weather prediction (the cartoon by R.K. Laxman has a puzzled weatherman getting drenched at a bus-stop since he did not carry his umbrella: "Yes. I work in the Met Dept., but how did you know?). ❑

Popular Lectures on Biotechnology at IICB

A series of three popular lectures on Biotechnology were arranged by the Indian Institute of Chemical Biology (IICB), Calcutta, on 21-25 February 1997, with a view to creating scientific awareness amongst students and interested general public. The programme was sponsored by the Department of Biotechnology, Government of India.

Dr J. Das, Director, IICB, inaugurated the series. Shri Nikhiles Mitra, Coordinator of the programme, introduced the speakers. Dr (Smt.) Chitra Datta, Scientist, IICB, delivered a lecture on 'Application of Computer in Biology: Modelling & Simulation; Dr Santu Bandopadhyay, Scientist, IICB, on 'Immunology at the Cross-roads'; and Prof. D.P. Burma of the Banaras Hindu University, on 'Molecular Basis of Life'.

A total of about 900 students from 16 different schools & colleges attended the lecture series and interacted with the scientists. ❑

Resources Development Centre at RRL, Bhopal

A modern Resources Development Centre equipped with computational facilities and information technology tools was inaugurated at the Regional Research Laboratory (RRL), Bhopal, by Prof. S.K. Joshi, former Director General, CSIR, on 20 March 1997. Smt. Tinoo Joshi, Commissioner, Directorate of Sericulture, Government of Madhya Pradesh; Dr Ram Prasad, Director General, M.P. Council of Science & Technology, Bhopal; Prof. T.C. Rao, Director, RRL, Bhopal; and a large number of invitees were present on the occasion.

Inaugurating the Centre, Prof. S.K. Joshi stressed the importance of linkages between R&D and user agencies, and complimented RRL for bringing about this welcome linkage with the M.P. State agencies on water resources studies.

Smt. Tinoo Joshi in her address spelt out the relevance and specific S&T needs of sericulture farms. She lauded the efforts made by RRL in several significant projects like watershed management, artificial recharge and computer-aided studies.

Prof. Rao welcomed the guests and mentioned that RRL has endeavoured to build up viable expertise in resources management, particularly water resources. In the past three years, the laboratory has developed technical and functional linkages with Central and State agencies like Department of Science & Technology, Ministry of Rural Development, UNICEF, Central Ground Water Board, Rajiv Gandhi Mission for Watershed Develop-

Prof. S.K. Joshi, ex-Director General, CSIR (third from left), after inaugurating the Resources Development Centre at RRL, Bhopal. Prof. T.C. Rao, Director, RRL, Bhopal, is seen on extreme right

ment, State Water Resources Department and M.P. Council of Science & Technology. He cited example of a survey conducted in water scarce regions of Dhar district at the instance of UNICEF and mentioned that the recommendations of the laboratory have been accepted for implementation. The projects on water management for sericulture would be a major challenge, he pointed out.

In its endeavour to provide Science & Technology inputs to the development programmes of the State of Madhya Pradesh, RRL has been interacting with the Rajiv Gandhi S&T Missions. The laboratory has an ambitious programme of providing innovative watershed management practices, Prof. Rao added.

Dr R.N. Yadava, Head, Resources Development Division, RRL, Bhopal, conducted the programme and proposed a vote of thanks.

About the Centre

The Resources Development Division in RRL-Bhopal was formed in 1990 while restructuring/reorienting its charter of activities. The Centre has mandate to carry out computer-aided studies in integrated water resources management, supported by field studies and surveys. Main capabilities of the Centre are in Resource Modelling and Systems Analysis. The Centre carries out following major activities in the area of Water Resources Management:

- Groundwater Resources Management
- Watershed Development
- Land & Water Resources Management and Planning
- Groundwater Contamination Studies

Specific Areas of Expertise

Water Resources Management

- Drought-prone areas
- Water-logged areas
- Sericulture farms

Watershed & Wasteland Development

- Planning and Development of mini watersheds
- Reclamation of wastelands for irrigation and fodder development

Artificial Recharge Studies

- Identification of sites and type of structure for artificial recharge
- Development of microcatchment-wise artificial recharge plans

Database Management

- Development of Natural Resources Database Management System for various districts of M.P.

Remote Sensing and Geographical Information System

- Preparation of thematic maps such as those on Geology, Geomorphology, Land use/Landcover, and Hydrogeomorphology
- Development of GIS for Water Resources Management

Groundwater Contamination

- Evaluation and assessment of polluted areas
- Development of methods for monitoring of environmental pollutants
- Development of management plans for contaminated aquifer

Since the formation of the Division in 1990, efforts have been made towards organizing independent research projects in the above areas with the existing infrastructure and manpower by having meaningful interactions with user agencies like Rajiv Gandhi Mission for Watershed Development, Government of M.P.; Water Resources Department; M.P. Public Health Engineering Department; Tawa Ayacut Development Authority, Government of M.P.; Directorate of Sericulture, Government of M.P.; Water and Land Management Institute, Bhopal; Central Water Commission; Central Ground Water Board; NABARD; UNICEF; National Environmental Engineering Research Institute, Nagpur; National Fertilizers Ltd, Vijaipur, M.P.; through a number of technical meetings, discussions and workshops. In addition, the Centre has been able to establish linkages with international institutions of repute such as University of California, Santa Barbara, USA; Institut für Angewandte Geowissenschaften, Germany; USA Waterways Experimental Station, Vicksburg, USA, University of Waterloo, Canada, University of Hertsford, U.K., etc. ❑

Honours & Awards

Dr Kalachand Sain

DR Kalachand Sain, Scientist, National Geophysical Research Institute, Hyderabad, has been awarded the 1996 Krishnan Medal of Indian Geophysical Union for his contributions to the field of Geophysics.

Dr Sain is actively involved in processing of normal incidence seismic reflection data and inversion (both travel time and wave form) and modelling of seismic refraction and wide angle reflection data with a view to studying the variation of subsurface velocity structure and related phenomena. He laid emphasis on new methodologies for extracting velocity depth functions from wide angle seismic data.

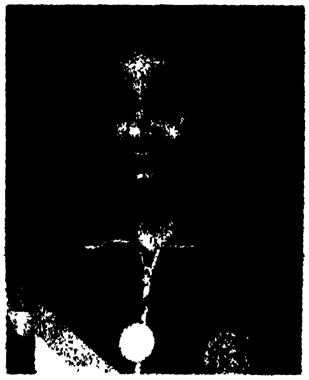
Dr Sain is currently engaged in delineating the submarine Gas Hydrate bearing structures and in this connection he has undergone training in advanced seismic data processing at the BIRPS, Bullard Laboratory, Cambridge University.

Dr Sain joined NGRI as Research Fellow and did his doctoral studies in Geophysics. He obtained Ph.D degree in 1995 from the Osmania University for his work on 'Inversion of seismic wide angle reflection travel times with applications'.

Dr Kalachand Sain receiving the Krishnan Gold Medal from Dr Harsh K. Gupta, President, IGU and Director, NGRI

Shri D.K. Gautam

SHRI D.K. Gautam, Scientist, Central Building Research Institute, Roorkee, who participated in the 19th National Veteran Athletic Championship (45 years age group) as a representative of Uttar Pradesh, has won the Gold Medal in Javelin Throw. The meet was held at Kanpur from 27 February to 2 March 1997 in which about two thousand athletes from all over India took part in different events. On the basis of record performance, Shri Gautam has been selected to represent India at World Veteran Athletic Championship, to be held at Durban, South Africa in July 1997.

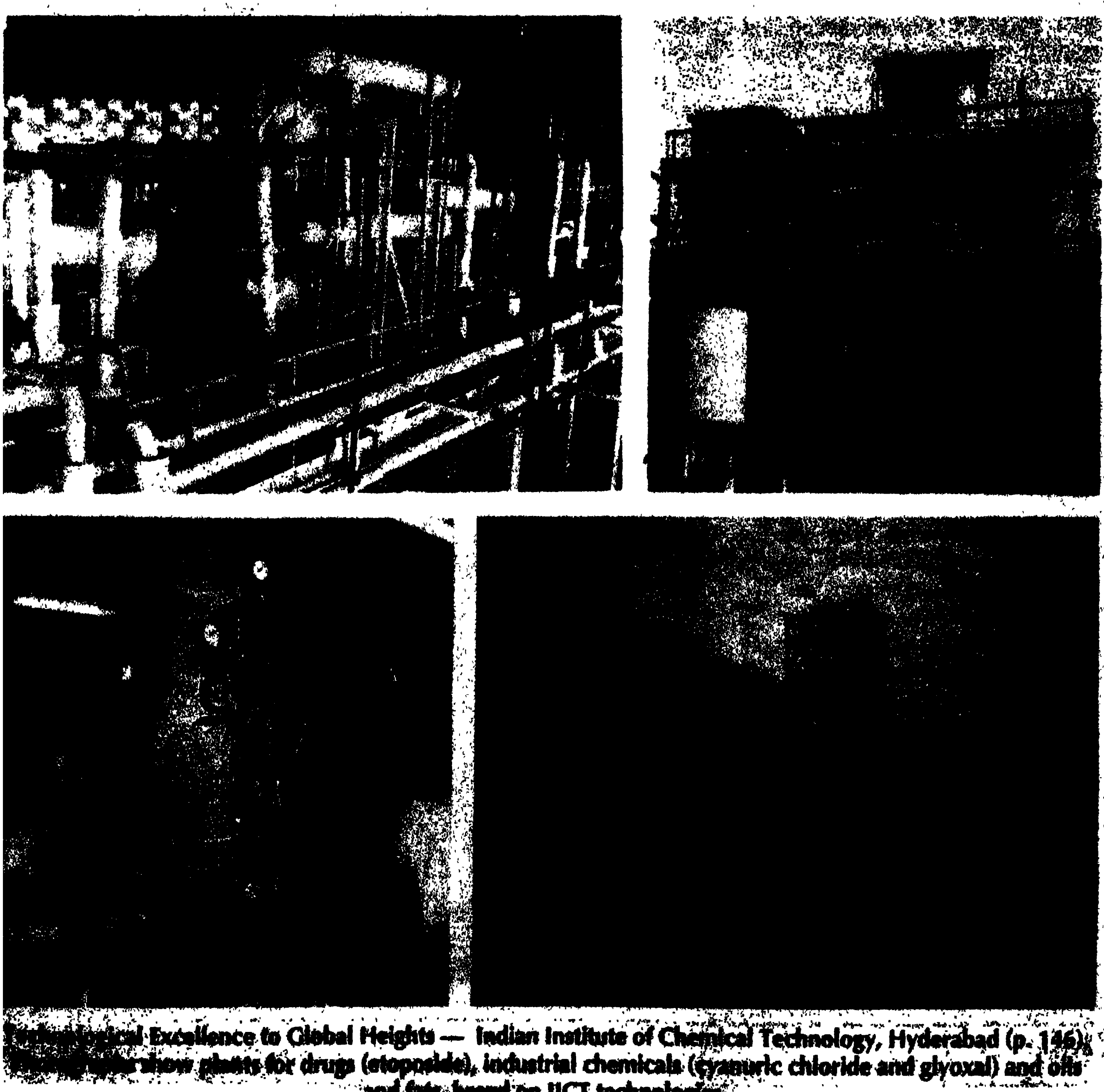


Shri Gautam also stood second in the Shotput event in the 11th U.P. State Veteran Athletic Championship, held in February 1997, prior to the National Championship. ❑

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi-110 012
Printed at NISCOM Printing Unit
Annual Subscription : Rs. 60
Editor : Dr B.C. Kashyap Editorial Assistant : Neelima Handoo Production : Kaushal Kishore Single Copy : Rs. 3.00
PUBLIFORM Telex : 031-77271 E-mail: niscom@sirnetd.ernet.in. Fax : 5787062

ISSN 0409-7467

CSIR NEWS



Technological Excellence to Global Heights — Indian Institute of Chemical Technology, Hyderabad (p. 146). Photographs show plants for drugs (etoposide), industrial chemicals (cyanuric chloride and glyoxal) and oils and fats, based on IICT technologies.

INDIAN INSTITUTE OF CHEMICAL TECHNOLOGY, HYDERABAD — Technological Excellence to Global Heights

THE Indian Institute of Chemical Technology (IICT), Hyderabad, is a multidisciplinary R&D centre committed to innovative research leading to the development of cost-effective technologies in the areas of : Agrochemicals and integrated pest management, Drugs and pharmaceuticals, Organic intermediates, Fine chemicals, Lipid sciences/engineering, Surface coatings and polymers, Dyes and intermediates, Catalysis, Bioremediation and control, Biotransformations, Chemical engineering, Mechanical engineering and design, Coal utilization, Chemical and bioevaluation, Simulation and optimization, Hazard and risk analysis of chemical plants.

The institute has a proven record of significant contributions to the Indian chemical industry, particularly in the field of agrochemicals, drugs, oils and fats, polymers, surface coatings, catalysis and chemical intermediates. It enjoys an international reputation for its basic scientific research in organic synthesis and catalysis.

A notable trend, following the opening up of the market in India to international competition after the liberalization reforms is the surge among the multi-nationals to scout around India for forging R&D alliances with R&D institutes like IICT and some of them have already finalized arrangements with IICT for collaborative and contract research programmes. This has led IICT to develop into an unequalled market-driven and performance oriented institute. The story of IICT's outstanding track record in industrial research, from concept to commercialization, on its road to become a global R&D Centre, with a client base covering several leading chemical companies is a fascinating one. Areawise major accomplishments include:

AGROCHEMICALS

The need for enhanced food production is universal, more so for a country like India. In this pursuit, the role of pesticides in crop protection from insects and plant diseases and safe storage is well recognized.

The disciplined approach to strategic innovation is the key factor that brought IICT into international focus.

Till the 70's the Indian agrochemicals' requirement was mostly met by imports. In 90's, nearly 60% of basic pesticides manufactured in India are based on IICT technologies. This change has come through hard work, scientific excellence and enduring IICT-Industry relationship.

Design process being adopted by IICT for development of new molecules with fungicidal and in-

IICT TECHNOLOGIES: AGROCHEMICALS

COMMERCIALLY SUCCESSFUL TECHNOLOGIES

- Monocrotophos [5000 TPA (16)]
- Butachlor [1500 TPA (4)]
- MBC [300 TPA (1)]
- Thiophanate Methyl [300 TPA)]
- DDVP [1050 TPA (3)]
- Diazinon [300 TPA (1)]
- Chlorpyriphos [1700 TPA (13)]
- Quinalphos [300 TPA (1)]

(No. of Licencees indicated in brackets.) Some of the major licencees are: NOCIL, Vantech, NICL, JKBM, Voltas, Sudarshan, Chemagro, Lupin, AIMCO, FICOM, Montari, HIL, and MBC.

PROCESSES BEING DEVELOPED

- Esfenvalerate
- Acephate
- Glyphosate
- Lamda Cyhalothrin
- Cypermethrin
- Neem-based Anti-feedant

PROCESSES PROPOSED FOR DEVELOPMENT

- Cartap
- TAU-Fluvalinate
- Fipronil
- Imidacloprid
- Profenophos
- Chlorothalonil
- Penconazole
- Imazethapyr
- Diofenolan
- Hexaflumuron
- Tefluthrin
- Bifenthrin
- Acrinathrin
- Metalaxyl
- Pendimethalin

RANGE OF TECHNOLOGY OUTPUT AND SERVICES

- Process knowhow •Upscaling facilities •CIB Registration Data Generation •Hazard and risk analysis •Trouble shooting •Basic/detailed designs with performance guarantees for Plant capacity and Product quality •Inplant studies •Chemical equivalence and impurity profile •Analytical/Testing of Chemicals •Advisory consultancy on retainership basis.

secticidal activities. Apart from synthetic compounds, active constituents from natural products are being also screened. The highpoints are:

- IICT technologies on eight broad spectrum pesticides are in commercial production by 14 companies; 11 more projects are being implemented. Their total installed capacity is of the order of 11,000 TPA.
- Twenty-five major companies have received IICT agrochemical technology packages.
- Estimated annual turnover based on IICT technologies is around Rs 8000 million.
- Under a collaborative programme with DuPont, IICT has taken up the screening of 500-600 molecules for synthesis; emphasis being on new compounds.
- As an important constituent of the multi-institutional programme of DOD to screen commercially potential marine plants for bioactive molecules, IICT has identified 5-6 potential compounds for detailed investigations.
- IICT has done extensive studies on identification and synthesis of pheromones for insects/pests for cotton, groundnut and sugar cane crops. TNO of The Netherlands and IICT have collaborated in the development of applicators. One of the Indian companies has already taken up the pheromone technology from IICT. More companies are likely to show interest in this technology in view of its eco-friendly concept.
- IICT received CSIR Technology Shield (1990) for its overall contribution to agrochemical research, and Technology Prize (1996) for trimethyl phosphite technology transfer.

DRUGS & PHARMACEUTICALS

Committed to scientific excellence for realizing 'Health for All', the institute is pursuing an ambitious programme for development of cost-effective technologies for life-saving drugs.

The IICT research programme in this sector is not based on just proving hypothesis but firmly articulated on the best of the both worlds approach, namely high technology-based process development for market-driven health care products and committed scientific excellence in new molecule synthesis. The

IICT TECHNOLOGIES : DRUGS & PHARMACEUTICALS

COMMERCIAL SUCCESSES

- Azidothymidine (Anti-AIDS)
- Etoposide (Anti-cancer)
- Flurbiprofen (Analgesic)
- Timolol Maleate (Anti-glaucoma)
- Metoprolol (Cardio-vascular)
- Gemfibrozil (Anti-cholesterimic)
- Nadolol (Cardio-vascular)
- Diltiazem (Cardio-vascular)
- Ciprofloxacin (Anti-bacterial)
- Norfloxacin (Anti-bacterial)
- Sulbactum (Anti-bacterial)
- Astemizole (Anti-histaminic)
- Mefloquine (Anti-malarial)
- Omeprazole (Anti-ulcer)
- Keterolac (Analgesic)
- Pyrazinamide (Anti-TB)

TECHNOLOGIES BEING DEVELOPED

Chiral Drugs for
- Cardio-vascular
- Respiratory
- Anti-inflammatory
- Analgesics
- Anti-histamine
- Anti-infectives
- Anti-virals

Other Drugs
- Cycloserine
- Ethionamide
- Nabutamone
- Taxol
- Vitamin-A
- Ibuprofen
- Stavudine

TECHNOLOGIES FOR FUTURE DEVELOPMENT

- Clarithromycin (Anti-bacterial)
- Lamivudine (Anti-AIDS)
- Ofloxacin (Quinolone)
- Tenidap (Anti-inflammatory)
- Sumitriptan (Anti-migraine)
- Misoprestone (Confirmed)
- Estradiol (Hormonal)
- Pentoprazole (Anti-ulcer)
- Loratidine (Anti-histamine)
- Meropenem (β-Lactam-antibiotic)
- Cefixime (β-Lactam-antibiotic)

PACKAGES OF TECHNOLOGY OUTPUT AND SERVICES

- Process Knowhow •Upscaling Facilities •Basic and Detailed Engineering •In-plant/Trouble Shooting Studies •Project Engineering Assistance •Chemistry and Process Improvements •Analytical Testing •Chemical Equivalence and Impurity Profile Assessment •Bioevaluation •Human Resource Development •Advisory Consultancy on retainership.

achievements which merit mention are:

- Methaqualone, a non-barbiturate hypnotic drug, was first synthesized at IICT.
- Entire R&D on market-driven process technologies is sponsored by industry.
- More than 25 life-saving drug technologies have been transferred to industry.
- Annual turnover of Indian drug industry, based on IICT technologies is more than Rs 1500 million.
- IICT received CSIR Technology Prize (1991) for synthetic drugs and CSIR Prize (1993) for Azidothymidine (anti-AIDS) and Ketorolac (analgesic).

Several multinational companies have shown their keenness to avail IICT's expertise in developing internationally competitive process technologies for drugs and pharmaceuticals. Negotiations are in advanced stage with DuPont-Merck, Cytomed, Searle, Austinal and Cargill of USA and ICI of UK.

A recent development has been the launching of an ambitious programme for discovery of new bioactive molecules with therapeutic applications. Indian drug companies like Ranbaxy, SOL and Lupin have come forward to support the programme, both financially and technically.

IICT has also entered into a long-term agreement with NIH and NCI of USA for biological screening of new molecules developed by the institute for anti-AIDS and anti-cancer applications.

INDUSTRIAL ORGANIC CHEMICALS AND INTERMEDIATES

The general parameters that govern the selection of intermediates for the chemical industry are their strategic importance, import substitution potential, cost-effectiveness and expertise for the development of the technology. IICT has developed technologies for glyoxal, sodium azide, benzyl chemicals, hydrazine hydrate, trimethylphosphite, etc., and more recently the technologies for strategic chemicals like cyanuric chloride, o-amino phenol and others. The technologies that are receiving attention presently are CFC substitutes, CO and downstream chemicals, hydrazine hydrate, pyrazinamide. etc.

Under the TIFAC's Home-grown Technologies Programme, IICT has entered into an agreement with M/s Navin Fluorine and SRF to develop a pilot scale technology for HFC-134a from trichloroethylene, with HFC-133a as the intermediate. An efficient catalyst has been developed for the halogen exchange reactions using HF. Process standardization in a bench scale reactor is nearing completion and a pilot plant facility is under erection. The HFC process technology is technologically most challenging and, on successful completion, IICT will be one of the four / five institutions in the world to develop such a technology.

Realizing the potential of C_1 chemistry in generating a variety of high-value and low-volume chemicals, IICT has initiated research work on CC based chemicals. A pilot plant of 5 kg/h capacity for the production of CO, using petroleum coke as feedstock, has been set up, and a pilot plant facility for the downstream chemicals commissioned. The technology for phenyl acetic acid was successfully demonstrated to M/s Rashtriya Chemicals and Fertilisers, Mumbai. The process development work on Vitamin-A and Ibuprofen based on CO is in progress.

CATALYSIS AND MATERIAL SCIENCE

R&D in catalysis is a globally frontier area of research in view of its importance to the modern manufacturing industry, including food, drugs, fine chemicals and organic intermediates. The work carried out at IICT in basic catalysis research has attracted the attenion of the peer groups at an international level. It spans homogeneous and heterogeneous catalyses. Significant contributions have been made with respect to anchored and pillared clays, organometallic and zeolite-supported metal catalysts. IICT is also making significant contributions to the area of material science, related to silicon carbide whiskers, semiconducting materials, boron nitride thin films, etc.

Catalysts for hydrogenation of benzene, 2-methyl pyrazine, acetonitrile, CFC substitutes and other products have been developed. The European Commission, Indo-French Centre and DST (Govt. of India) have formed formal linkages with IICT in the development of catalysts/processes.

SURFACE COATINGS AND POLYMERS

R&D emphasis in this area is on the development of technologies for materials of industrial importance like adhesives with applications ranging from structures to surgery, rigid polymer foams, wood substitutes, polymer materials for controlled release of bioactive materials, paints and paint formulations, non-toxic water-based polymers and polymer sprays for anti-erosion and other applications.

Under the sponsorship of Aeronautical Development Agency (ADA), Bangalore, IICT has developed technology for preparation of a low-loss polyester resin for use in fabrication of radome of the Light Combat Aircraft (LCA), which meets all international specifications with regard to field performance. The resin resists aerodynamic loading, retains dimensional stability even under extreme temperatures and is electromagnetically transparent.

IICT TECHNOLOGIES: SURFACE COATINGS, POLYMERS AND ADHESIVES

POLYMERS AND SURFACE COATINGS

- Iron oxide pigment from iron ore fines
- Polyurethane coatings formulations
- CNSL-based paint coatings
- Hydrogenated cardanol for lubricants/paints
- Anti-corrosive paints for steel structures
- Cardanol and cardanol-based [illegible] for paints and varnishes
- Epoxy resin for [illegible]
- Water soluble coatings

ADHESIVES

- Polychloroprene adhesive for bonding shoe soles (leather), automobile upholstery
- [illegible]
- Acrylic pressure-sensitive adhesive for [illegible]
- [illegible]
- Cyanoacrylate adhesive
- Gum for [illegible] fields
- PVC [illegible]
- Adhesive by [illegible]
- [illegible]

OILS & FATS

IICT is a Centre of excellence in R&D on oils & fats. The contributions of the institute have resulted in:

- Development of process for value-added, toxic-free high protein, edible grade cottonseed flour as protein food
- Acceptance by the Government of India for the use of cottonseed oil in the manufacture of vanaspati as partial substitute to imported edible oil, thereby saving valuable foreign exchange. Presently annual production of the cotton seed oil in the country is about 350,000 tonnes, as against the potential demand of 550,000 tonnes.
- Production of salseed fat by processing of salseed, which is considered to be a forest waste, for utilization in confectionery industry.
- Development of Rota Disc Stabilizer for thermal stabilization of rice bran to obtain edible rice bran oil, under the Technology Mission on Oilseeds & Pulses (TMOP) project.
- Production and utilization of Dehydrated Castor Oil in paints and varnish industry.
- Development of technologies for value-added products from castor oil for its better utilization to meet the country's requirements and avoiding export of raw castor oil.

The institute has recently set up a pilot scale pyrolyzer for castor oil processing with 10-undecenoic acid and heptaldehyde. This technology, on commercialization, will be the single largest user of castor oil for manufacture of nylon 11 for which 10- undecenoic acid is the precursor. The second product, viz. heptaldehyde, on oxidation to the corresponding acid/polyester, finds application in high-performance aviation lubricants. The institute, in association with the Indian Oil Corporation, Faridabad, proposes to develop a wide range of synthetic lubricants based on vegetable oils for the aviation industry.

IICT TECHNOLOGIES: OILS & FATS

COMMERCIALLY SUCCESSFUL TECHNOLOGIES

- Processing of cottonseed
- Chemical cotton from cotton linters
- Dehydrated castor oil (DCO)
- Hydrogenated castor oil (HCO)
- B.S.S. grade castor oil
- Salseed processing

PROCESSES READY FOR TRANSFER

- 12-Hydroxystearic acid
- Methyl 12-hydroxystearate
- Ricinoleic acid
- DCO fatty acid
- Dimer acid
- Rota disc stabilizer for rice bran
- Simultaneous dewaxing and degumming of rice bran oil
- Expoxidized castor oil
- Food-grade wax from rice bran and sunflower oil
- Triacontanol

PROCESSES UNDER DEVELOPMENT

- 10-Undecenoic acid/heptaldehyde
- Heptanoic acid
- Sebacic acid / 2-octanol
- Oryzanol
- Carotenes from crude palm oil
- Hydrocarbon fuels from jatropha and other oils

PROCESSES PROPOSED FOR DEVELOPMENT

- Castor oil
  - Ethoxylated products
  - Polyols substitute for Polypropylene glycol (PPG)
- Rice bran oil
  - Thin-film deacidifcation
- Palm oil
  - Methyl ester sulphonates
- Alternative solvents (eco-compatible) for vegetable oil extraction
- Lubricants from Vegetable oils

RANGE OF SERVICES/EXPERTISE

• Product development • Process knowhow • Basic/detailed designs with performance guarantees with regard to raw materials, plant capacity, product quality • Upscaling facilities • Hazard and risk analysis • Trouble shooting • Inplant studies • Analytical testing of oils & fats • Advisory consultancy on retainership basis

COAL

The challenging task of utilization of low-grade Indian coals taken up by IICT at its very inception has

[illegible]

led to the development of technologies for low-temperature carbonization, briquetting of char fines and processing of carbonization by-products. These have been successfully commercialized by the industry.

Pilot-plant investigations carried out on the total gasification of a wide variety of Indian coals in a moving bed gasifier have resulted in the generation of design data for power plants based on the modern and more efficient method of power generation by the *Integrated Gasification Combined Cycle.*

The institute is currently looking at the prospects of tailoring the gasification technology for the generation of high-value and relatively low-volume chemicals in the medium-scale industry. IICT-BHEL have jointly offered to set up semi-commercial coal gasification plants in the state of Gujarat. The institute is vigorously pursuing with the Government of India the launching of a mission mode programme for utilization of coal technologies developed by CSIR laboratories and other institutes.

CHEMICAL ENGINEERING

The institute has consolidated its long and varied experience of several years and presently possesses expertise in process technology development, process design for commercial plants, optimization of intricate chemical processes and properties evaluation. It has also gained national recognition in the area of chemical hazard and risk analysis.

IICT DETAILED ENGINEERING SERVICES

DETAILED ENGINEERING PACKAGES

- Glyoxal (5 TPD)
- Sodium azide
- Trimethyl phosphate (7 TPD)
- Cyanuric chloride (2.2 TPD)
- Pesticide complex
- Castor complex

SETTING UP PILOT/PROVING PLANTS

- Carbon monoxide (6 kg/h)
- HFC-134a (5 kg/h)
- Castor oil pyrolysis (15 kg/h)

DESIGN ENGINEERING SERVICES TO EXTERNAL INSTITUTIONS

- Fluidbed reactor (NML, Jamshedpur)
- Nickel extraction (RRL, Bhubaneswar)
- Ammonia and stripping (NMDC, Hyderabad)
- Rock phosphate benefication (RRL, Bhopal)
- Test rig for random coating (ADA, Bangalore)
- Multipurpose pilot plant (DMSRDE, Kanpur)
- Pigment grade iron oxide (NMDC, Hyderabad)

PLANT AND DESIGN ENGINEERING

IICT has long since recognized the crucial role played by mechanical design and engineering in the conversion of process designs into detailed engineering designs for setting up commercial manufacturing plants.

The record of smooth and successful transfer of technologies from this institute to the chemical industry is made possible by the inputs contributed by the design engineers of this institute. The setting up of a CAD facility a few years ago has greatly enhanced the performance of this group in optimizing the designs, reducing project implementation time, perfecting piping layouts, etc. The department is also engaged in the development of software for design of commercial plants which are extensively used for inhouse design engineering activities and other institutions.

IICT'S TECHNICAL SERVICES

IICT is equipped with the most sophisticated analytical instrumentation, multipurpose pilot plants, mechanical workshop, computer hardware and software facility for process analysis, simulation and optimization, and specialized bench scale and pilot plants. The institute

IICT's PERFORMANCE INDICATORS

	1990-91	91-92	92-93	93-94	94-95	95-96
PAPERS PUBLISHED	215	153	158	182	175	143
PATENTS						
Filed:	10	13	8	10	13	36
Granted:	4	5	[illegible]	10	6	3
KNOWHOW	1992-93	93-94	94-95	95-96		
Licensed (No.)	25	19	6	8		
Agreement Executed (No.)	64	48	52	32		
Industrial Production:	Rs 1000 million (1992-96)					
CONTRACT RESEARCH (CONTRACT VALUE)						
	1992-93	93-94	94-95	95-96		
(I) Sponsored Projects (Rs million)	32.5	40.00	53.10	115.20		
(ii) Consultancy (Rs million)	10.60	7.30	15.90	22.8		
REVENUE GENERATION						
	1992-93	93-94	94-95	95-96		
Total Revenue Generation (Rs million)	29.20	44.50	50.10	52.80		
Revenue as % of Current Expenditure	33%	49%	48%	48%		
Revenue as % of Total Expenditure (including capital expenditure)	27%	40%	31%	40%		

offers following services to the industry:

- Job works employing IICT infrastructural facilities
- Chemical testing and characterization
- Chemical equivalence and impurity profiles of agrochemicals/drugs
- Entomological, toxicological and pharmacological evaluation of bio active molecules
- Computer software development
- Techno-economic feasibility studies
- Process, basic and detailed engineering designs of chemical process plants
- Inplant studies for process restandardization
- Training in specialized areas
- Environmental impact assessment studies
- Design fabrication of specialized equipment

EXCELLENCE IN BASIC RESEARCH

IICT is a nodal institute working on various facets of basic research in frontline chemical science areas. The institute has more than 200 research fellows/associates engaged in doctoral and post-doctoral research programmes. It is recognized by more than 25 universities, Indian Institutes of Technology and other institutes of higher learning for doctoral research in chemical, biological and engineering sciences.

The major thrust in biological and engineering areas lies in synthesis of new organic, inorganic and organometallic molecules with potent biological activities. The pioneering contributions of IICT have been in the synthesis of Fredericamycin-A, Aranorosin Niphatesines A-D, Hericenone-A, Geodiamolide-D Rhizoxin, Campothecin, Rapamycin, etc.. The recent innovations have come from research teams engaged in the synthesis of naphthylisoquinoline alkaloids, calanolides, β-lactums and a new range of immuno suppressants. The latest addition to the synthesis of complex natural products includes Routinnocin, Alterobactins, Echno candint, Balanol and Zankiren.

Another important dimension added to the organic chemistry work at IICT involves asymmetric synthesis. The urge to develop compounds in those forms which nature makes or bilogical activity demands has led to the development of many asymmetric processes with a very high enantiomeric success. The notable successes of IICT are in the asymmetric synthesis of β-methylthienamycin, chloramphenical and chiral β blockers.

The successes achieved in the basic research work relevant to the development of catalysts/processes of future industrial importance include aromatization of isophorone, selective hydrogenation of phenol, using novel Pt-Cr/C catalyst, VPO/γ-alumina for solid/solid Wittig reaction, zeolite catalysts for the synthesis of methyl piperazine and new molecular sieve catalysts for inter molecular and intra molecular cyclizations, amination of C_1-C_3 alcohols/aldehydes/ketones, ammoxidation of picolines and synthesis of silico alumino phosphate (SAPO) and vanadium alumino phosphate (VSAPO) molecular sieves.

The use of anchored and pillared clay catalysts for the oxidation of terminal olefins and for benzylic and allylic oxidations respectively is a major development in homogeneous catalysis. IICT is also specializing in C1 chemistry employing carbonylation reaction.

IICT'S PIONEERING CONTRIBUTIONS TO ORGANIC SYNTHESIS

ANTI-VIRALS

- β-Thymidine
- AZT analogues

CYCLIC PEPTIDES

- Vancomycin
- K-13
- Glycopeptides
- β-Hydroxy aryl amino acids

MACROLIDES

- Azamacrolides
- Clonostachydiol

POLYUNSATURATED HYDROXY FATTY ACIDS

- Trihydroxy (92,152)-octadecadienoic acid
- Trioxillion B3, A3

ENZYME CATALYZED REACTIONS

- Cyclization
- Deprotection
- Bio-oxidation conversions

MOLECULAR RECOGNITION OF DNA

- M avium serotype 4
- M Bovis
- M xeropi

NATURAL PRODUCT CHEMISTRY

- Isolation of camptothecin
- Isolation of taxoids

PHOTOCHEMISTRY

- Mechanistic studies
- Synthesis of photonic materials
- *cis-trans* isomerization

The deposition of thin films of diamond and C-B-N has been the main thrust of basic research in the area of Materials Science. Also a plausible mechanism of CVD has been proposed based on gas phase decomposition studies. The basic work on gas sensors, based on semiconductors is leading to interesting practical applications in hydrofluoro carbon detection.

The basic research studies in Organo Metallics relate to organocobaltoximes in organic synthesis, cobalt-mediated reactions of thiols, new organotin catalysts and compounds, etc.

The application of computational chemistry in designing nonlinear optical materials for stilbenes and quinones, molecular modeling of endo/exo-cyclic hydrocarbons and crystal structure solution through packing energy calculations is the main theme in this area.

The basic research programme in the area of oils/fats has been tailored keeping in view the future prospects for new derivatives. A novel lipase hydrolysis has been evolved to concentrate erucic acid glycerides. The other basic studies cover QSPR studies on saturated and unsaturated fatty acids, kinetics of C_{36} dimeric fatty acid reaction with ethylene diamine, synthesis of biologically active fatty acids, 1-triac- ontanol, 3-alkenoic acids and long chain 1,4-alkane diols. The current efforts on the application and mechanistic studies on reverse micelle-mediated extractions and reactions are noteworthy.

The basic research in Biological Sciences covers: biological control of pests of economic importance, bioactivity of insect pheromones, entomological evaluation of agricultural pests and mechanistic approach to the neuromuscular junctions, diabetes and inflammation.

Studies are being also carried out on mathematical modelling of chemical reaction systems, new process dynamics and control strategy development, development of pervaporation for efficient separation of valuable constituents from lean aqueous mixtures and application of neural networks, fuzzy logic and artificial intelligence to real systems.

Studies in the field of Analytical Chemistry include unusual ion-molecule reactions under chemical ionization conditions employing mass spectrometry, structure and conformation of molecules of basic interest in chemistry and biology by employing NMR spectroscopy, development of more efficient procedures and pulse-sequences for NMR and NQR; and crystal structure elucidation by novel X-ray techniques. This is also an area of intense IICT-University collaborations.

Further details regarding the IICT technologies/services can be had from: The Director, Indian Institute of Chemical Technology, Hyderabad 500007. [Attn. Business Management Area]
Phone : 91-040-673289/673943
Fax: 91-040-673757.673387
E-mail: root @ csiict. ren. nic. in ❑

CIMAP celebrates Annual Day

THE Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, celebrated its 38th annual day on 2 April 1997, by organizing a function in which eminent scientists of the country and elite of the town were present. The former Director of Indian Agricultural Research Institute and former Deputy Director General, ISNAR, Hague and Chairman of the Research Council of CIMAP Dr H.K. Jain presided over the function while the Director General, CSIR and Secretary, Department of Scientific & Industrial Research Dr R.A.Mashelkar delivered the Annual Day lecture. CIMAP Director Dr Sushil Kumar presented the CIMAP's research highlights of the year 1996-97.

Delivering the Annual Day lecture, Dr Mashelkar praised the efforts of CIMAP in developing agro- and processing technologies of various medicinal and aromatic plants and taking the same to the farmers' fields for large scale utilization by the poor people. He also emphasized the importance of customer satisfaction in these areas, and suggested for development of some mechanism for the quantification of societal benefit accruing from the use of CIMAP technologies.

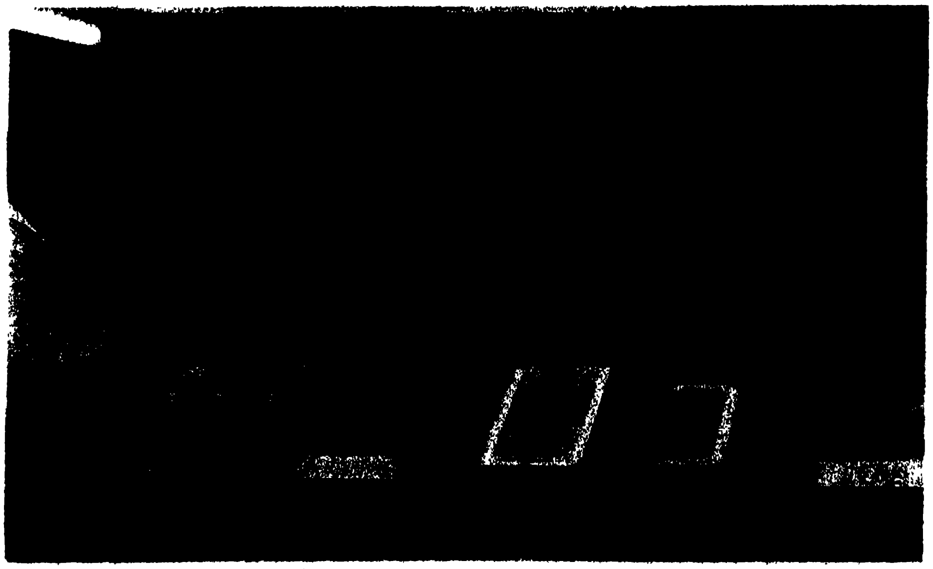
Dr Mashelkar stressed that the science in the country must make economic and social sense. '*CSIR-2001 - A Vision*', which sets target for future strategy of scientific activities has been prepared keeping this in mind. "To accomplish this target, though we have drawn a road map in the right direction, we are still required to move at a particular rate, which is yet to be ensured," he pointed out and urged the CSIR workers not to be moderate while dreaming for the country's scientific advancements. He said that irrespective of political scenario in the country, CSIR has continued to receive enormous support for its plans and programmes, and in the same spirit, the government has sanctioned a modernization grant of Rs 50 crore to CSIR.

Talking about the challenges which the country faces today, Dr Mashelkar said that our richness lies in our resources and knowledge which are not being properly used for the benefit of the nation. "This richness should be utilized to its maximum to create wealth and prosperity in the country," he observed. For this, an Intellectual Property Management Division (IPMD) has been created by CSIR to make the fullest and appropriate use of the already present and newly generated knowledge for the benefit of the county, he added.

Dr Mashelkar also urged the S&T community to use the highest level of technology in each and every field of research for better results and ensuring consumers' satisfaction. He laid emphasis on the removal of the rigid compartmentalization between different disciplines of science, in order to bring them together, for better results in development and growth.

Dr Mashelkar congratulated the staff members of CIMAP for the excellent work they had done during 1996-97. He called upon the scientists to devote more time in developing new technologies, products and materials meeting the need and interest of the farmers and entrepreneurs.

Earlier, presenting the research highlights of the year 1996-97, Dr Sushil Kumar, Director, CIMAP, informed the gathering that the CIMAP's work has made India as the world's main producer of mint oils and menthol. He said that an yield of over 10,000 tonnes of *Mentha arvensis* (menthol mint) oil is expected from the cultivated area of



Dr R.A. Mashelkar, Director General, CSIR, releasing the book on *Indian Medicinal and Aromatic Plants Facing Genetic Erosion*, on the occasion of CIMAP's Annual Day about 75,000 ha this year. This will lead to a business of about five thousand crores, and provide employment to about five lakh people for about seven months.

He further told that CIMAP has completed a number of experiments and trials on mint and released a number of improved agrotechnologies for the use of farmers. A new variety of the menthol mint, *Mentha arvensis,* christened as *Himalaya* has been developed. Oil yield potential of this variety is in the range of 300 kg per hectare. It is tolerant to the main diseases and pests of the plant prevalent in India. CIMAP is on the way of taking an international patent on this variety. Some 331 farmers are trying out this variety in their fields. Among these are included 60 farmers of 14 villages who are being helped under the Ambedkar Vishesh Rojgar Yojna sponsored by the Department of Rural Development, Government of Uttar Pradesh.

The other R&D highlights of the year 1996-97 mentioned by Dr Sushil Kumar are:

To obtain high yields of oil from the prevailing and *Himalaya* varieties of *Mentha arvensis,* a package of practices is being transferred. Farmers have been given a transplanted mint technology using which rice-wheat and rice-potato rotations have been replaced by rice-wheat-mint and rice-potato-onion-mint rotations, fetching a minimum of Rs 75,000 profit per hectare. The technologies are now spreading much beyond the *Tarai* areas of Punjab, Haryana, U.P. and Bihar. Mint cultivation is picking up in the foot hills of Nilgiri and Palni hills and the coastal areas of Andhra Pradesh and Tamil Nadu.

A procedure has been developed for the production of chemical fertilizer from the mint waste that can be used in nurseries, to further the profits of mint farmers. A hand driven wheeled tool device for hoeing and weeding in the mint field has been developed.

The adoption of new technologies for the cultivation of geranium developed by CIMAP will make India an exporter rather than an importer of the geranium essential oil. Selections have been developed which have better adaptation in the environment of north Indian plains. A suitable propagule development technology has been standardized. The most profitable planting and harvesting schedule has been worked out. With the use of these techniques it is now possible to incorporate geranium in the rice-toria and rice-potato crop rotations. A method for the co-cultivation of geranium and garlic has also been developed. These technologies are expected to bring to the farmers a profit of Rs 90,000 - 130,000 per hectare. CIMAP has developed somaclones of geranium that yield higher quality of oil which is rich in geraniol, citronellal or both. These clones are under large scale field testing.

Intercropping of the legumes, green gram and black gram with citronella has been shown to enhance the yield of the main crop by 25% in the first and the second year of cropping. Palmarosa, lemongrass and vetiver have been shown to ameliorate the sodic soils. They can be profitably cultivated in rain fed saline or sodic soils or in agroforestry systems under the plantations of Eucalyptus or poplar. A new variety of lemongrass called *Krishna* has been made available. This variety yields about 200 kg of high quality oil per hectare which is about double the yield obtained from the best of the old varieties.

The gene bank at CIMAP campus in Lucknow developed with the funds of CSIR and DBT now has about 1500 accessions of 200 species of plants. These genetic resources are being characterized and enhanced for the selection of relatively potent and better adapted genotypes. Two of which — WS-10 of Ashwagandha and M-20- 22 of Isabgul — are in advanced stage of trial. Another set of accessions has been identified for release as cultivars. *Dhawal* of periwinkle yields about 15 mg of vincristine 250 mg of vinblastine per hectare. *Sona* of senna has about 2.5-fold richer in sennosides as compared to the prevalent varieties. Also being released are *Mishree* of liquorice, *Maru Sudha* of guggul and *Aekla* of *Hyoscyamus niger.*

The gene bank has a cell line of ginseng whose 4-week old cultures accumulate as much ginsenosides as found in the roots of a 4-year old ginseng plant. The tissue cultured ginseng product is proving to be as efficaceous as ginseng roots in the pharmacological trials being conducted in collaboration with CDRI.

CIMAP has made considerable headway in its programmes relating to the medicinal plants *Artemisia annua* and *Taxus baccata.* It may be recalled that CIMAP in collaboration with CDRI had developed an antimalarial drug arteether. The Phase III clinical trials at several centres in India on the simple and complicated cases of *Plasmodium falsiparum* malaria were completed this year. The Drug Controller of India has since released the drug for use in hospitals. The technology to derive arteether from artemisinin has already been made available to a few drug companies in India. This year, CIMAP has perfected a liquid-liquid biphasic separation technology for the extraction of artemisinin and artemisinic acid from the dried herb material of *Artemisia annua*. This technology is economically viable in that the use of silica gel is minimal and more than 90% of the solvents are recovered.

The Indian variety of *A. annua* is rich in artemisinic acid. This compound being a precursor of artemisinin can be synthesized into artemisinin. A procedure for the extraction of artemisinic acid was made available earlier. Now a laboratory scale method has been developed for the conversion of artemisinic acid into artemisinin with 40% yield. It has been found that a densely populated crop of *Artemisia annua* planted in September at the rate of two lakh plants per hectare yields about 7.5 kg of artemisinin and 40 kg of artemisinic acid. The agrotechnology of artemisinin production is being further improved.

Taxus baccata trees that carry in their bark 0.05% of taxol and 0.5% of a taxol analogue have been identified. These are being used as a source of explants for tissue culture. A procedure has been perfected to convert the taxol analogue into taxol with 50% yield. Until now 24 different taxoides have been isolated and characterized from the leaves, bark and heartwood of *Taxus baccata* plants. Commercial procedures for the isolation of major taxoides have been standardized. The chemical synthesis of side chains for the semi synthesis of taxol from its precursors has been achieved. Some of these technologies have been transferred to industry.

Rapid procedures have been developed for the screening of individual plants of opium for alkaloids, *Ashwagandha* for withanolides, *Brahmis* for baccosides and asiaticosides, *Kalmegh* for andrographolides. Using these procedures, thousands of individual plants of the available accessions have been screened to identify the promising genotypes.

Commercial procedures have been developed for the conversion of menthol to menthyl acetate, methyl chavicol to anethol, citral to saffranol and for the isolation of antisweet gymnaemic acid from gurmar.

Commercial extraction procedures have also been standardized for obtaining stable edible dyes from marigold flowers, black carrot and beet root, dhak flowers and safflowers.

CIMAP has developed and is now conducting clinical/field trials on a number of herbal formulations including pain balm, stored food grain protection tablet, mosquito repellant lotion, skin crack cream and house fly deterrant, and a pesticide for crop protection.

CIMAP has joined an inter-laboratory project of CSIR for the possible development of the chemicals isolated from the plants by the institute into drugs of importance. In CIMAP itself a group has been established for the isolation and testing of the extracts from identified medicinal plants. The objective of CIMAP is to work towards fourth generation antibiotics. In this regard, two activities have been identified that are lethal to the bacteria which harbor resistance to potent third generation antibiotics. In the genetic resources and biotechnology division, the molecular biology group has initiated work on the DNA fingerprinting of the genetic resources of Indian medicinal and aromatic plants.

During the year, CIMAP has improved its infrastructure considerably and also its input into research. CIMAP scientists submitted over 125 manuscripts for publication and 20 applications for the grant of patents. One international patent was filed.

CIMAP earned EBR of about 31.0 million this year as against 20.6 million in 1995-96 and 14.8 million in 1994-95. In 1996-97, the institute sold its technologies and products through more than four thousand transactions. It trained 348 persons in the cultivation and processing technologies of medicinal and aromatic plants. In brief, CIMAP is moving in the direction of meeting the objectives and targets of the *CSIR's 2001 Vision*.

On this occasion, Dr Sushil Kumar thanked all the present colleagues and paid tribute to the people who helped the organization in the past.

Presiding over the function, Dr H. K. Jain emphasized that the research should be effectively linked with the user industry. He said that a system be developed for feedback from the users to assess the performance of the technology under field condition. Urging the scientists to concentrate upon a few important programmes and activities in the area of medicinal and aromatic plants, he called upon them to develop a plant-based perfume of international standard, a herbal tea and a health care product for the use by the common people.

On this occasion, four new high yielding cultivars developed by CIMAP — *Himalaya* of menthol mint, *Krishna* of lemongrass, *Sona* of senna and *Aekla* of black henbane — were dedicated to the nation by Dr Jain and Dr Mashelkar. Six new publications brought out by CIMAP were also released by them, which include three farm bulletins, one each on *Artemisia annua*, chamomile and rosemary, a directory of buyers of medicinal and aromatic plant materials and a book on the Indian medicinal and aromatic plants facing genetic erosion, and CIMAP annual report for 1996-97. ☐

SEMINARS

Modelling of Biological Process

A one-day seminar on 'Modelling of Biological Process', organized by the Indian Institute of Chemical Biology (IICB) and Department of Mathematics, Jadavpur University, was held on 20 January 1997 at IICB.

In his welcome address Dr J. Das, Director, IICB, expressed his happiness over the presence of a huge galaxy of scientists from different areas at the seminar. He emphasized the need for interaction between the diverse fields such as mathematics and biology. He also stressed the importance of theoretical research in the frontiers of biology in the present scenario of rapid advancement of biological sciences.

Prof. K.S. Chowdhury of Jadavpur University introduced the various activities of his department in his introductory remarks.

Two foreign delegates, Prof. L. Segal of Israel and Dr A. Goldbeter of Belgium, presented their papers. Other speakers were Dr C.N. Mandal (IICB)), Dr C. Mukherjee (Bose Institute), Prof. R. Majumdar (SINP), Prof. A.B. Roy (JU), Dr A. Nandy (IICB), and Prof. K. Bhowmick (SINP).

Vote of thanks was offered by Dr Chitra Dutta of IICB. A booklet containing the abstracts of papers was distributed among the delegates. ☐

Seen on the dais during the seminar on 'Modelling of Biological Process' (from left) are: Prof. K.S. Chowdhury, Dr J. Das, Prof. L. Segal and Dr C.N. Mandal

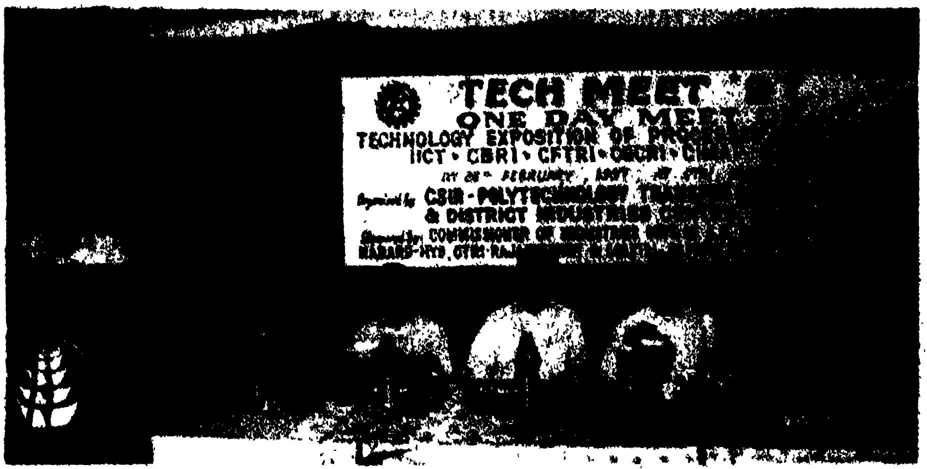
TECH MEET'97 at CTRI, Rajahmundry

THE CSIR - Polytechnology Transfer Centre, Hyderabad [PTC(H)], in association with the District Industries Centre, Kakinada, organized Tech Meet'97, a one-day meet on technology exposition of processes developed by Indian Institute of Chemical Technology (IICT), Hyderabad; Central Food Technological Research Institute (CFTRI), Mysore; Central Glass & Ceramic Research Institute (CGCRI), Calcutta; Central Institute of Medicinal & Aromatic Plants (CIMAP), Lucknow; and National Environmental Engineering Research Institute (NEERI), Nagpur, at the Central Tobacco Research Institute (CTRI), Rajahmundry, on 26 February 1997. The objective of this meet was to fill the information gap between technology generators and users, specially that pertaining to CSIR technologies relevant to Coastal Districts of Andhra Pradesh, and also to provide an opportunity to the prospective entrepreneurs to select a technology/project of their interest from the wide range of technologies/expertise available and/or to take up collaborative projects. The programme was sponsored by the Commissioner of Industries, Government of Andhra Pradesh, IICT, SIDBI, Coastal Papers Ltd, and CTRI.

Shri M. Harischandra Prasad, Chairman & Managing Director of Andhra Sugars Ltd, Tanuku, inaugurated the programme. Shri P. Laxminarayana Naidu, Addl. Commissioner, Government of A.P., presided over the function. Dr K.V. Raghavan, Director, IICT, delivered the keynote address. Shri C. Bhaskar, Director, Coastal Papers Ltd, released the Tech Meet'97 Souvenir. Shri G.A. Reddy, Project Officer, welcomed the participants and explained about the programme. Shri N.C. Harshavardhan, Scientist and Programme Coordinator, PTC(H), proposed a vote of thanks. Around 150 delegates, representing various industries, industrial associations, entrepreneurs, promotional and financial institutions participated. An exhibition of the products/samples/charts/photographs with write-ups related to the various technologies developed by the participant laboratories was also arranged.

Dr K.V. Raghavan in his keynote address said that there is a good scope for development of petroleum refineries and steel (port-based); palm, rice-bran and castor oils (agro-based), and chemical gas-based industries in Andhra Pradesh. There is also a very good scope for packaging industry, and development of herbal plantations on which the future of drug industry depends. He said that Andhra Pradesh produces maximum number (8500) of export- oriented items and pointed out that for proper utilization, a survey of available resources, preparation of techno-economic feasibility reports and identification of proper technologies would be essential.

Inaugurating the meet, Shri Harischandra Prasad observed that India was blessed with vast natural resources and skilled technical and managerial manpower. Exploitation of these requires technological intervention. Since bottlenecks such as inadequate infrastructure and outdated bureaucratic control are being removed, the industry would be able to grow at a faster rate and meet ever increasing global demands. Stressing the need to make science relevant to industry, Shri Prasad urged the scientists to work in that direction. He also appealed to scientists manning research labs to be more transparent, and extend cooperation to the entrepreneurs.



Shri G.A. Reddy welcoming the delegates of Tech Meet' 97. Seated on dais (from left) are: Dr K.V. Raghavan, Director, IICT; Dr K. Nagarajan, Director, CTRI; Shri M. Harischandra Prasad, Chairman & Managing Director, Andhra Sugars Ltd, Tanuku; and Shri P.L. Naidu, Addl. Commissioner, Government of Andhra Pradesh

Dr K. Nagarajan, Director, CTRI, spoke on the possibilities of developing tobacco not only for smoking and chewing but also for industrial purposes.

Shri P.L. Naidu talked about the changes in the policy framework to help industrialization.

The inaugural function was followed by two technical sessions in which the following papers were presented: Chemical & Allied Products (Shri G. Sampath Kumar, Scientist, IICT, Hyderabad); New & Alternative Building Materials (Shri B. N. Iyer, Scientist, CBRI, Extension Centre, Hyderabad); Food & Agro-based Products (Dr D.G. Rao, Scientist & Head, CFTRI Extension Centre, Hyderabad); Cultivation & Extraction of Aromatic & Medicinal Plants (Dr Kamla Singh, Scientist-in-Charge, CIMAP Extension Centre, Hyderabad); Environmental Monitoring, Systems Design, Hazardous Waste Management (Dr M. Vittal Rao, Scientist-in-Charge, NEERI Extension Centre, Hyderabad); Technology Transfer and Assistance from PTC(H) [Shri N.C. Harshavardhan, Scientist, CSIR-PTC(H)]. .

The technical sessions were followed by the valedictory function in which Shri S.K. Khare, President-Operations, Andhra Pradesh Paper Mills Ltd, Rajahmundry, called upon the delegates to utilize the opportunity offered by Tech Meet'97 and set up industries in the Coastal Districts of A.P., based on CSIR technologies.

There was a good interaction and lively discussions between the scientists and other participants on various CSIR technologies. ❑

Prof. S. Mohan appointed Director, CSIO

PROFESSOR S. Mohan, formerly Chairman and Professor in the Department of Instrumentation, Indian Institute of Science, Bangalore, took over as Director, Central Scientific Instruments Organisation (CSIO), Chandigarh, on 24 April 1997, consequent upon the retirement of Prof. K.R. Sarma. He is the sixth Director of the institute.

Prof. S. Mohan (born on 10 March 1946) obtained his Ph.D. from the S.V. University, Tirupathi in 1974. His area of specialization has been design and development of Thin Film Devices and Vacuum Instrumentation. Prof. Mohan has succeeded in achieving the best combination of Basic Physics and Technology realizing its importance to Indian industry. His contributions are in the area of thin film devices which include design of new processing technologies, plasma analysis, deposition parameter-structure-property correlation, materials research, modelling of thin film growth processes and design and development of thin film devices.

A number of R&D projects funded by departments of Space, Defence and Atomic Energy have been successfully executed under his dynamic leadership and the technology transferred to industry. The research work carried out by his group on laser coatings resulted in developing coatings which withstood high powers of lasers. These are being used by Centre for Advanced Technology and Bhabha Atomic Research Centre. This work has also got him recognition in the Round Robin of Optical Society of America and put his group on the international map. Prof. Mohan was invited thrice by US Airforce to deliver window on science talks at US Airforce Weapons Laboratory, Albuqurque, USA and by US Naval Research Laboratory, Washington, USA. Prof. Mohan played a key role in developing High-pressure Oxygen Sputtering Technique and analyzed it thoroughly to prepare high-quality superconducting films. This technology has been transferred to industry.

His group also has the credit of introducing two new techniques, viz. Unbalanced Magnetron Sputtering and Triode Ion Plating. These techniques are now being used to deposit highly sophisticated coatings for Surface Engineering. He has been actively associated with many Indian and foreign industries and R&D laboratories in the development of coatings for erosion and corrosion resistance.

His group besides designing and developing the beam combiner, a special optical filter, demonstrated its production in an Optoelectronics factory in Dehra Dun and Bharat Electronics Limited, Machilipatanam. This item is a part of the Head-up- Display developed by CSIO, and has been identified as one of the best import substitutes for the Light Combat Aircraft.

'Rotating crucible electron beam evaporation' is another technique, first of its kind in the world, developed in his laboratory. Its potential has been proved in preparing multi-component, homogeneous as well as graded films. Two more techniques: (i) Rotating Target Ion Beam Sputtering and (ii) Facing Target Sputtering, developed by his group, have helped him to establish collaboration with Royal Melborne Institute of Technology, Melborne, Australia, which is actively involved in the area of micromachines. The thin form strain gauge sensors developed by his group have found applications in satellites, biomedical instruments, and these are now being extended to mining applications.

Prof. Mohan has extensively contributed to human resource development by organizing national and international conferences, industry-institute meetings and short-term courses for R&D scientists from industries and universities.

His published work includes, among others, 100 R&D publications in refereed journals and 100 papers in national and international symposia. He has also contributed several invited review articles in journals, and book chapters. He has been invited a number of times to deliver invited talks and chair sessions in international conferences. He has extensively travelled in USA, UK, USSR, Canada, Germany, Japan, The Netherlands, Yugoslavia, Malaysia, Singapore, and delivered invited lectures. He was a Visiting Professor at Forschung Centrum, Julich, Germany and Pennsylvania University in USA.

Prof. Mohan has been associated with a number of professional societies, funding agencies and industries within the country and abroad. He is a member of the editorial board of an international journal, *Vacuum* (Pergamon Press, UK), and *Advances in Materials Processing* (Chapman & Hall, UK), and Indian journals such as *Journal of Optics* and *Bulletin of Surface Engineering.*

Prof. Mohan was selected as a UGC National Associate in 1977. In 1981, he was honoured by Andhra Pradesh Academy of Sciences with 'Young Scientist Award'. Materials Research Society of India honoured him with 'MRSI Medal' in 1992. The Department of Science and Technology identified him as an SERC Lecturer in 1993. He is a fellow of Andhra Pradesh Academy of Sciences. ❑

Honours & Awards

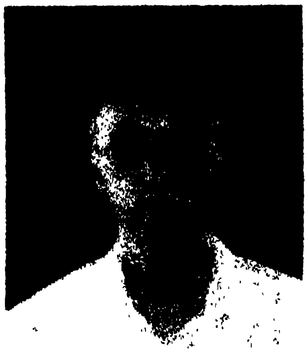
Dr S. Narayanan

DR S. Narayanan, Deputy Director, Indian Institute of Chemical Technology, Hyderabad, has been elected Fellow of the Andhra Pradesh Akademi of Science (APAS). The fellows of APAS are drawn from distinguished elites in the related disciplines of Science & Technology.

Dr P.R. Reddy

DR P.R. Reddy, Scientist F and Project Leader, Controlled Source Seismology, National Geophysical Research Institute, Hyderabad, has been awarded the 1995 National Mineral Award by the Ministry of Mines. Government of India, for his contributions to the field of Geophysics.

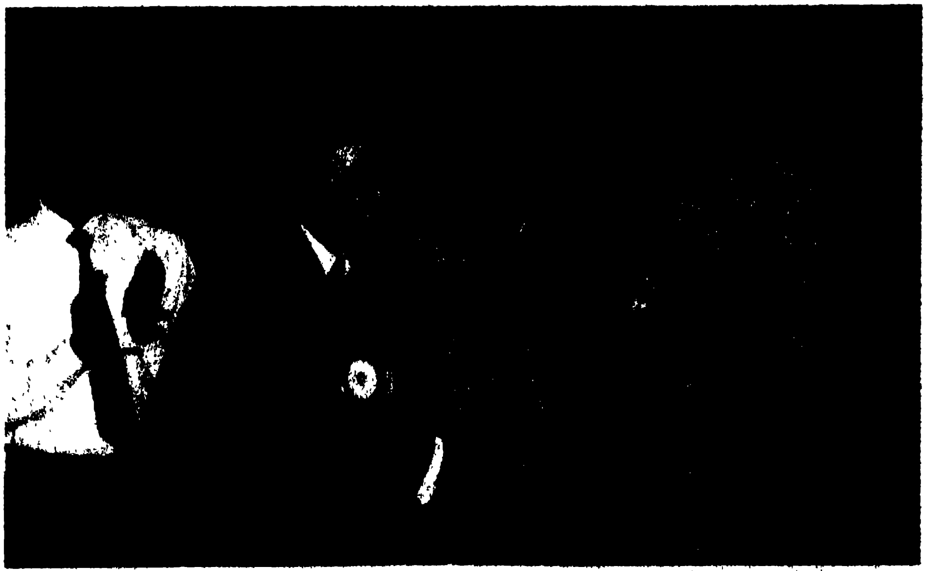
Dr Reddy made significant contributions in Earthquake and Controlled Source Seismological Studies to bring out crustal and sub-crustal lithospheric velocity structure in different geological terrains of the country. His work relating to the shallow seismic refraction studies to delineate the sub-trappen mesozoic sediments in Saurashtra has far reaching importance to oil exploration programmes.



He has more than 40 research papers in national and international journals and 15 technical reports to his credit. He is a Fellow of Indian Geophysical Union and Association of Exploration Geophysicists. •

Dr A.N. Mukherji

DR A.N. Mukherji, Technical Officer E-II, National Metallurgical Laboratory (NML), Jamshedpur, has received 'MASCOT National Award' in recognition of his meritorius contributions to the field of Industrial Corrosion Science and Technology. The award was presented to him by Prof G.V. Subba Rao, Director, CECRI, on the occasion of NSEST-96, organized by the Electrochemical Society of India at Indian Institute of Science, Bangalore. The award carries a scroll of honour, a gold medal and a cash prize. ❑



Dr A.N. Mukherjee receiving the MASCOT National Award

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit

Annual Subscription : Rs. 60
Single Copy : Rs. 3.00

Editor : Dr B.C. Kashyap
Editorial Assistant : Neelima Handoo
Production : Kaushal Kishore

Phone : 5786301
Gram : PUBLIFORM
Telex : 031-77271
E-mail: niscom@sirnetd.ernet.in.
Fax : 5787062

ISSN 0409-7457

CSIR NEWS

CECRI-NFC to provide technical know-how for NALCO's Gallium Plant

THE Ministry of Mines has accorded approval for setting up a 1- tonne per annum (3N grade)/950 kg per annum (5N grade) gallium extraction plant by National Aluminium Company Ltd (NALCO) at its Alumina Refinery, Damanjodi. The agreement for transfer of technology was signed between NALCO and National Research Development Corporation (NRDC), in New Delhi on 21 March 1997, by Shri N.V. Badi, Executive Director (CP&BD), NALCO and Shri N. K. Sharma, Managing Director, NRDC. Shri S.N. Johri, CMD, NALCO; Shri A. Parthasarathi, Secretary, Ministry of Non-conventional Energy Sources and other representatives of different associated agencies like DSIR, DST, CECRI, EIL, Planning Commission and others were present on this important occasion.

The project cost is estimated at Rs 94.6 million, out of which NALCO will provide Rs 53.5 million and the balance amount of Rs 41.1 million will be provided by the Government of India as grant-in-aid from DRDO, DSIR, DST and NRDC.

The technical knowhow shall be provided by the Central Electrochemical Research Institute (CECRI), Karaikudi, and Nuclear Fuel Complex, Hyderabad, for extraction and purification technologies respectively. The project will be completed within a period of 18 months.

This project has great significance as gallium is a strategic metal. It has been gaining worldwide importance by virtue of its application in electronics industry. The established commercial applications of gallium in compound forms include light emitting diodes, microwave and milliwave integrated circuits, lasers, superconducting magnets, magnetic bubble memories and high current switches. ❑

NCL-WSU Collaborative Research Programme on Chickpea

INDIA is expected to have a population of one billion by the turn of the century. Given the subsistence nature of Indian agriculture and its emphasis on sustainable agricultural practices, the only way to feed more people is to make crop production more efficient. Cereals and pulses constitute a major portion of an Indian diet, which in combination can provide a reasonably balanced diet. Amongst the pulses, chickpea (*Cicer arietinum*) represents about 30% of the total area under cultivation and 37% of the total production, and thus is the major pulse grown in India. Despite its importance in the Indian diet, chickpea, production levels have remained stagnant during the past 15 years, the serious constraints being susceptibility of chickpea to diseases and pests. The major fungal diseases caused by Fusarium wilt and Ascochyta blight and pests such as pod borer contribute significantly to limit chickpea yields.

NCL-WSU Partnership

In its worldwide crop biotechnology programme, the McKnight Foundation, USA, has selected National Chemical Laboratory (NCL)-Washington State University (WSU) partnership to carry out collaborative research on chickpea. The main objective of this programme is to improve the productivity of chickpea by using biotechnological approaches to develop chickpea varieties that will be resistant to major diseases and thereby improve the earnings of the Indian farmers. The specific goal of the project in the first stage is to develop protocols enabling the introduction of foreign genes into the chickpea, to produce a detailed map of the plant's genetic makeup and to tag genes for disease resistance using molecular markers. Apart from research, the programme also includes a strong training component to provide a framework to expand the scientific infrastructure —technology and highly trained researchers — to enhance India's self-reliance. As a nucleus to educate future generations of agricultural scientists, eight Indian graduate students will receive training at Washington State University and will receive postdoctoral support to continue their research in India.

Training Workshop at NCL

In its commitment to train Indian scientific community in advanced biotechnological research in relation to chickpea breeding, a short-term training course on DNA markers for improving efficiency of chickpea productivity was organized by the Indian PIs at the Division of Biochemical Sciences, NCL, during 2-16 March 1997. A total of 14 participants representing various agricultural universities, research stations and institutes all over India attended this course. The participation from leading chickpea breeding centres such as Hissar (Haryana), Kanpur (Uttar Pradesh), Rahuri (Maharashtra) and ICRISAT (Andhra Pradesh) was a prominent feature of the course.

The aim of the course was to acquaint the candidates with the basic techniques in DNA marker technology and its applications, to generate their interest towards molecular breeding and to help them initiate work in this direction in their own institutions. The two-week training course involved basic experiments in RFLP analysis of plant genomic DNAs, use of microsatellite markers in diversity analyses, identification of RAPD markers and their segregation in F2 progeny and computational analysis of the data.

In addition to laboratory experiments, invited guest lectures were delivered covering various aspects of chickpea breeding and scope for improvement in chickpea productivity using DNA markers. Dr Fred Muehlbauer, research geneticist from Washington State University, USA (collaborating institute for the ongoing chickpea programme) delivered two lectures on: mapping populations for molecular breeding and use of molecular markers in plant breeding. He had informal discussions with participants on various aspects of Marker Assisted Selection (MAS). The other external faculty consisted of renowned breeders and scientists involved in chickpea research, such as Dr R.P. Sharma (Indian Agricultural Research Institute, New Delhi), Dr A.N. Asthana (Indian Institute of Pulses Research, Kanpur), and three scientists, namely Dr H.A. van Rheenen, Dr M.P. Haware and Dr Jagdish Kumar from ICRISAT, Patancheru, Hyderabad. The participants had ample opportunity to closely interact with invited speakers and have fruitful discussions on various aspects of chickpea improvement.

The use of DNA markers, particularly for improving the productivity, may prove to be a practical solution to develop chickpea varieties resistant to biotic and abiotic factors was the message from the training course. The Indian collaborators now propose to initiate efforts to develop a national network of scientists to plan strategies which will ultimately lead to increased productivity of chickpea in the near future. ☐

High-density Grinding Media from Steatite Porcelains and Sintered Alumina

THE demand for high density grinding media with less wear and more efficiency has been increasing due to the stringent particle size requirements for various specialized applications in structural advanced ceramics. This field is fast growing and today most of the raw materials are synthetic and have a higher density. In order to grind them to finer particles within reasonable time grinding media of higher density is essentially required.

Steatite porcelains are used in various applications as high-temperature wire insulation, grinding media, liners, thread guides, coil formers, etc. to name a few. Similarly high-alumina ceramics applications are varied from electronic ceramics to refractories, abrasives, grinding media, etc. The technology for the production of these materials is available only with a few manufacturers in the country and hence not easily accessible to small-scale ceramic units.

The Naroda Centre of Central Glass & Ceramic Research Institute took up a project to develop both steatite porcelain grinding media and high-alumina grinding media, utilizing locally available raw materials.

The basic raw materials used in steatite porcelains are talc, china clay, feldspar, alkaline earth compounds while the basic raw materials for high alumina grinding media are calcined alumina, china clay, alkaline earth compounds and mineralizers.

The raw materials were selected from local indigenous sources as per the specific requirements formulated by the Naroda Centre. Talc used was of high purity, containing colouring impurities like iron oxide and titanium dioxide together less than 0.5%. China clay used in the formulation was plastic, possessing high unfired strength and was white burning. The physico-chemical and mineralogical properties of all the raw materials were carried out for proper selection of raw materials and incorporation in appropriate quantities based on the requirement of the product. Based on the several trials conducted, a few recipes were found suitable for commercial products. Test specimens in the form of 15 mm x 15 mm diam. cylinders were fabricated by pressing the blended granules obtained through wet grinding, filter pressing route in a suitable die set made of high chrome- carbon steel in a hydraulic press at a pressure of 2500-3000 kg/cm^2. The process adopted was similar for both steatite and high alumina grinding media. The steatite media were fired between 1240° and 1280°C with 2h dwelling time at the peak temperature whilst the alumina grinding media were fired between 1400°C and 1450°C with 2h soaking at the peak temperature. The rate of heating and the duration of firing totally depend on the composition of the batch, size and shape of the articles and the column of the kiln.

The fired materials were dense and possessed water absorption below 0.10%, white to creamish white and fine textured.

The most notable feature of the materials developed was the exceptionally high bulk density: 2.96 to 3.00 g/cc for steatite grinding media and 3.65 to 3.70 g/cc for high alumina grinding media. It is expected that the products developed will perform extraordinarily well under commercial production.

The technologies developed have been transferred to M/s Tripathy Ceramics, Ahmedabad, through a training-cum-demonstration Programme held at the Naroda Centre recently. The programme comprised theoretical lectures covering various aspects of production such as body compounding, preparation, drying, firing, quality maintenance, etc. followed by practical demonstration. The programme was highly successful and well received by the transferee. ❑

Dr K.N. Maiti, Scientist-in-Charge (*left*) handing over the know-how documents on Steatite Porcelain and Sintered Alumina Grinding Media to Shri Rajesh Tripathy, as Smt. Tripathy looks on

Multiple Disease-resistant cultivars of Japanese mint

STUDIES have been conducted at the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow's Pantnagar Field Station, under natural epiphytotic conditions, to identify multiple disease-resistant cultivars of *Mentha arvensis* (menthol mint). Eight different genotypes of *M. arvensis* were screened for resistance to rust (*Puccinia menthae*), powdery mildew (*Erysiphae cichoracearum*), leaf blight (*Alternaria alternata*), leaf spot (*Corynespora cassiicola*) and aerial blight (*Rhizoctonia solani*) under field conditions during March - July. The genotypes were coded as V-1, to V-8.

High-level resistance was recorded against rust and *Alternaria* leaf blight in four genotypes V-7, 3,2 & 1; against powdery mildew in genotypes V - 2,4,5,6 & 8; against *Cyronespora* leaf spot in genotypes V-2, 1, 3 & 7 and against aerial blight in genotypes V-2, 3, 1 & 6. High-level susceptible reaction was recorded against rust and *Alternaria* leaf blight in V-6 (cv. Shivalik) followed by genotypes V-8, 5 & 4, in that order. The rust-infected crop showed a drastic defoliation in the range of 60-65% which is directly attributable to reductions in herbage and essential oil yield through the destruction of foliar oil gland. On the basis of these observations, scientists have forecast that *Mentha* rust does possess a potential threat to *M. arvensis* crop, specially the cultivar 'Shivalik' in Tarai region of Uttar Pradesh. Further work will be done for selection of genotypes having multiple disease resistance against the above diseases including mint rust. ❑

Field view of mint rust infected Shivalik variety of Japanese mint

Ensuring the quality of *kewra* oil

THE attar, oil and water of *kewra* (*Pandanus odoratissimus*) are commercially used as flavouring materials for soft drinks, chewing tobacco and food products. In India, *kewra* grows widely in the coastal regions of Orissa and Tamil Nadu. Owing to very low oil yield, there is always a paucity of natural *kewra* oil. Further, the physico-chemical data for standard specifications of *kewra* oil have not yet been fully documented. Recently, the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, carried out GLC studies on oil samples available with perfumers in and around Lucknow and Kannauj including three authentic samples from Gunjam district of Orissa.

Estimation of major chemical constituents, and a study of optical rotation and refractive index indicated that phenylethyl methyl ether (PEME) and terpinen in the oil ranged between 75-84% and 8-15%, respectively, and the optical rotation between +1.1° & +2.8°. It has been suggested that a good *kewra* oil should have α_D between +2.0° to +2.8° and terpinen-4-ol not less than 10%. ❑

STRUCTURAL ENGINEERING RESEARCH CENTRE, CHENNAI
R&D Highlights: 1995-96

STRUCTURAL Dynamics, Experimental Mechanics and Wind Engineering; Offshore and Ship Structures; Steel Structures (Transmission Line Towers and other Skeletal Structures; Concrete Structures, Composites and Construction Engineering; and Computer-aided Analysis, Design and Software Development are the major areas of R&D of the Structural Engineering Research Centre (SERC), Chennai, During 1995-96, SERC pursued 20 inouse R&D projects and completed seven of these, achieving good results. A number of sponsored and consultancy projects, and testing services were also completed successfully.

Remarkable progress has been made in the SERC-UNDP project on 'Engineering of Structures for Mitigating Damage due to Cyclones'. Installation, commissioning and calibration of most of the instrumentation systems of the Atmospheric Boundary Layer Wind Tunnel facility have been completed and the wind tunnel made operational. Dr John D. Holmes, CSIRO, Australia (June 1995) and Prof. K.C.S. Kwok, University of Sydney, Australia (December 1995) visited SERC on consultancy missions under the UNDP project, and shared their experience on wind tunnel testing of low-rise buildings and field investigations on structures. A one-day workshop on 'Cyclone-resistant Design and Construction of Buildings and Structures' was held at SERC in October, to discuss the draft guidelines prepared by the Centre on the design and construction of buildings and structures in cyclone prone areas. Senior engineers from government, public and private sector organizations, representatives from voluntary agencies, Bureau of Indian Standards, and professionals from academic institutions participated in the workshop. Taking into account the deliberations at the workshop, the design guidelines have been finalized and sent to the Bureau of Indian Standards for incorporation in the relevant standards.

Performance Indicators 1995 - 96

In-house R & D Projects:	20
Projects Completed:	7
Sponsored Projects:	6
Grant-in-aid projects:	2
Consultancy Projects/ Services:	28
Software:	30 Load Modules of 14 Software packages released to 9 parties
Papers published :	66
Technical Reports :	39
Budget :	Rs 45.836 million
External Cash Flow :	Rs 18 million

The Terminal Evaluation Mission consisting of Prof. D. Surry, University of Western Ontario, Canada (Leader) and Prof. V.N. Gupchup (Government of India Representative), which visited SERC during January 1996, has commended the achievements made under the SERC-UNDP project and recommended that SERC be recognized as a Centre of Excellence for engineering of structures for mitigating damage due to cyclones. As an extension of activities in this area, the Centre has prepared a proposal for an 'Action Plan' for transfer of knowledge and technology developed under the UNDP Project.

The Centre conducted tests on a model of 220 m high chimney in the wind tunnel, to study the aerodynamic behaviour of the chimney for the Rajasthan State Electricity Board, Jaipur. Field investigations on steel lattice towers supporting wind energy generators were conducted for Elecon Engineering Corporation, Gujarat and also for Das Lagerwey Wind Turbines Ltd, Chennai, to determine the strength and safety of the tower structures and to provide suitable advice.

A project was taken up on 'Development of a Disaster-resistant Low-rise Building Construction System and Comparative Studies with Conventional Construction System', under the sponsorship of the Building Materials & Technology Promotion Council, Government of India.

The R&D investigations taken up by the Fatigue Testing Laboratory in the area of corrosion fatigue behaviour of tubular joints have progressed well. The special-purpose software packages n.Soft-E and KRAKEN have been installed and used in carrying out fatigue analysis under random loading. The Centre received several requests from the industry for fatigue testing and fatigue life evaluation of different type of structural components, including welded joints in rails.

A project on remaining life assessment of a tubular joint of an offshore platform in the Bombay High was successfully completed for the Oil and Natural Gas Commission. The Bhabha Atomic Research Centre, Mumbai, entrusted the Centre a project on fracture toughness evaluation of large diameter pipes, and the Tata Iron & Steel Company Ltd, Jamshedpur, sponsored a project on performance evaluation of rebars for use in structures in seismic zones.

The Tower Testing and Research Station (TTRS) of the Centre attended to a large number of requests from the industry seeking consultancy and testing services. It carried out tests on different type of transmission line towers, including a 500 kV rectangular tower and 400/63kV multicircuit tower, both for M/s KEC International Ltd, Mumbai, for their clients in Egypt and Iran, respectively, and towers with wooden cross arms for M/s Larsen & Toubro Limited, for use in Malaysia. Tests were also carried out on an insulator string used for 800 kV transmission lines. A number of parties entrusted the Centre with the job of design checking of 15, 40 and 60m microwave towers. The Centre has developed expertise in designing towers for 800 kV transmission including

Clockwise from bottom left - - 52 m tall narrow base tower instrumented for wind data measurements; data acquisition control facility for online measurement of wind data from a base tower; investigation of a scaled-down welded steel tubular joint; and finite element mesh for a multiplaner tubular joint self standing and guyed towers of different configurations.

The Scientist-in-charge of TTRS was invited by Queensland Electricity Corporation, Australia, to join the Task Force Committee meeting on High Intensity Winds on Transmission Lines and Design Workshop held in July 1995.

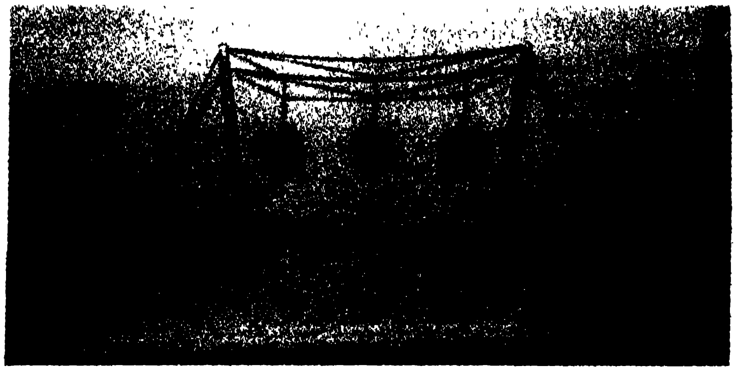
A sponsored project on investigating the suitability of square/rectangular hollow sections for the design of transmission line tower was taken up for Tata Iron & Steel Co. Ltd, Jamshedpur.

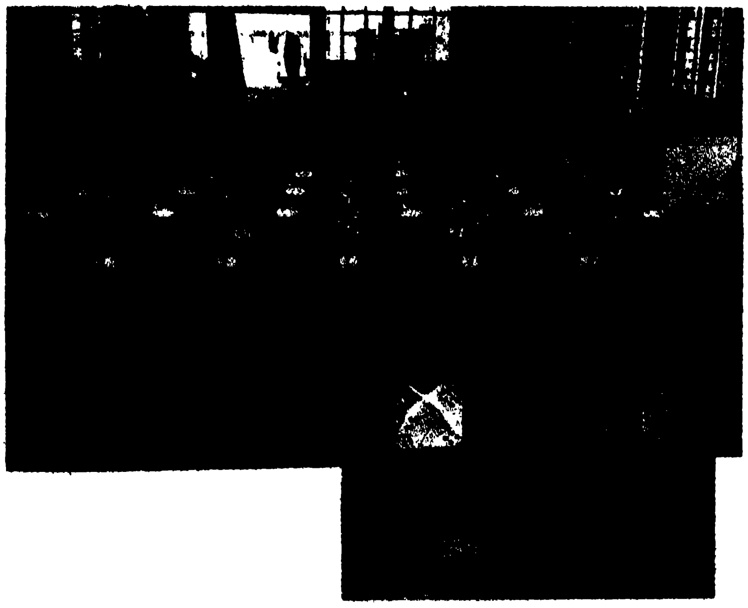
Considerable progress has been made towards the development of experimental techniques for measurement and analysis of strains/stresses in structural components in the nonlinear range. A project on static and dynamic analysis of mobile platform-based transporter-cum-tilter was taken up for the Research and Development Establishment (Engrs), Pune.

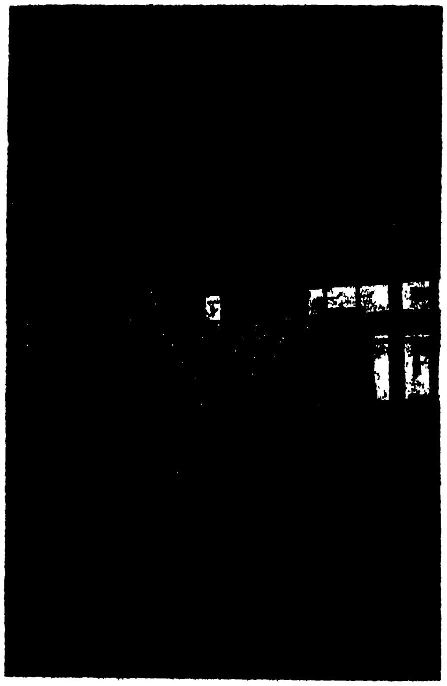
ONGC sponsored a project on investigations on the in-service gas pipeline across the river *Mindola*.

A grant-in-aid project on experimental and theoretical investigations on behaviour of buildings under acoustic loads due to satellite launch at Sriharikota Range (SHAR) was taken up for the Department of Space. The structures in the neighbourhood of launch pad were instrumented with accelerometers and data collected during the PSLV launch, for further analysis.

The experimental studies on dynamic behaviour of model piles and pile groups also made notable progress. Second phase of the consult-







Clockwise from top left — Computer-controlled data acquisition and analysis at the Fatigue Testing Laboratory; a laboratory model of 800 kV 'Chainett' transmission line tower; a concrete beam-column joint (reinforced with TMT bars) undergoing static load tests; and a space grid fabricated in the laboratory with the new jointing techniques (inset shows end-squeezed hollow steel sections with two type of modular connections) ancy project sponsored by Indira Gandhi Centre for Atomic Research, Kalpakkam, on behaviour of a stiffened cylindrical model tank under base excitation was initiated. Advisory assistance was provided to Tamil Nadu Electricity Board on a problem pertaining to the vibration of a 210 MW turbo generator foundation at the Tuticorin Thermal Power Station.

In the area of computer software development, 30 software load modules were licensed to different organizations. Software packages for design of RC INTZE water tanks and Windows-based Frame Analysis System, (WINFRAN) were developed and are available for release to the industry.

The Centre received a request from M/s Electrical Manufacturing Company Ltd, Calcutta, for carrying out further development of software for the design and detailing of transmission line multi-circuit towers.

An advanced course on 'Computer-aided Design and Expert Systems in Structural Engineering' was conducted by SERC in January 1996. Dr-Ing J. Altes of ISR, KFA, Germany, visited SERC during January-February 1996 to have discussions on the SERC-KFA collaborative project entitled 'Efficient and Reliable Finite Element Analysis of Structures and Components', involving development of adaptive finite element modelling techniques, parallel processing algorithms and software using graphic user interface.

Development of a software for computer-aided design and drafting of prestressed concrete grid systems was completed.

In addition to carrying out R&D studies on corrosion of reinforcements in concrete structures, the Centre took up a number of projects at the request of the industry and other agencies on damage assessment, repair and rehabilitation of structures.

Investigations were conducted to assess the structural integrity of the 116-year old Senate House building of Madras University, and recommendations made for its restoration and conservation.

Investigations were also conducted for the assessment of damage owing to fire of a framed building in the BPL factory at Bangalore. Repair and rehabilitation measures were recommended to restore the strength and stiffness of the building.

At the request of Tamil Nadu Industrial Explosives, Katpadi, structures which had shown distress were investigated and recommendations for repairs made for their restoration.

An advanced course on 'Design and Detailing of Reinforced and Prestressed Concrete Structures' was organized in February 1996, in which thirty senior engineers from different organizations participated. Based on R&D conducted at the Centre, recommendations were made to the Bureau of Indian Standards to improve the codal provisions of IS:456, presently under revision.

The Parliamentary Standing Committee on Science and Technology and Environment and Forests visited SERC on 5 July 1995. The team of members consisted of eleven MPs from both Lok Sabha and Rajya Sabha, led by Chairman Shri Syed Sibtey Razi. The Committee was very much impressed by the R&D achievements and the industry interaction activities of the Centre. The Chairman and members of the standing committee suggested that the Centre might also take up R&D in the area of earthquake engineering and disaster mitigation.

During the year, scientists of the Centre published 66 research papers and brought out 39 in-house technical reports, apart from presenting 19 research papers in conferences/seminars and delivering 29 invited technical talks in various organizations, academic fora, etc. Two of the papers have earned acclaim by receiving the Aerospace Engineering Division Gold Medal and the E.P. Nicolaide Prize of the Institution of Engineers (India). The two advanced courses and the workshop conducted during the year attracted a total of 115 senior engineering professionals and other participants.

The External Cash Flow of the Centre amounted to Rs 18.0 million, as against its budget of Rs 45.836 million during the year. ❑

NAL signs MoUs with Osmania University

THE National Aerospace Laboratories (NAL), Bangalore, signed a number of Memoranda of Understanding (MoUs) with the Osmania University, Hyderabad, on 17 May 1997. According to these MoUs, NAL is recognized as a Centre for Research for MS and Ph.D. degrees of the Osmania University. These MoUs cover University Colleges of Engineering (Autonomous), Technology and Science (Chemistry and Physics). One guide is required from NAL and one from the university. There would be no residential requirement at the university. ❑

Foundation Day Celebrations

Central Salt & Marine Chemicals Research Institute, Bhavnagar

THE Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, celebrated its forty-fourth Foundation Day on 10 April 1997. This year, the Foundation Day Lecture was delivered by the renowned chemical engineer, Prof. G.D. Yadav, Darbari Seth Professor of Inorganic Chemical Technology, Chemical Engineering Division, University Department of Chemical Technology (UDCT), Mumbai. The title of his lecture was 'Excitement Engineering : Rocks, Coals and Catalysis'.

A chemical engineer, Prof. Yadav said, is a person who enjoys the fruits of both engineering and science. Prof. Yadav, who has worked on ideas generating excitement out of seemingly unrelated areas and converting that excitement into an engineering practice, said that the ideas centred around pores and their connections to macroscopic occurences. Stating that everything around us is full of pores — some interconnected, conducting, accessible whereas some totally isolated — he cited a Sanskrit saying : *Chhidreshu anartha bahuli bhavanti* - meaning 'pores lead to many disasters and calamities'. However, he said, understanding pores and studies related to their physical properties like porosity, pore structure, surfaces and interfaces contained by them would lead to modification of above cited saying to *Chhidreshu vasati Saukhyam* — meaning 'prosperity lies in pores'. This he elucidated by giving the results of his work on recovery of oil, improving utility of coal and greener and efficient catalytic reactions leading to much needed products. Prof. Yadav described how, based on these studies, a patent was filed and a project was proposed to ONGC for enhanced oil recovery from oil wells. The process involves recycling of natural gas which is normally flared and lost. According to Prof. Yadav, existing methods of oil recovery leave behind a large quantity of oil in the strata or reservoir which based on their patented process can be pushed out economically as compared to other suggested routes/techniques. Even an additional one per cent recovery from a given reservoir is thousands of barrels of oil!

Prof. Yadav expressed that his group's studies on coal will lead to better coal benefication, coal liquefaction and gasification. Discussing the usefulness of studies on physical properties of pores in the catalysts and ion-exchange resins used in chemical industry, he showed the results his group obtained at UDCT, which lead to more efficient recovery, less byproducts generation and, thereby, less pollution, longer life of catalysts and resins, etc. The concepts of phase transfer catalysis, liquid-liquid- liquid phase reactors are innovations in chemical engineering. Single pot synthesis of methyl-tert-butyl ether (MTBE) which is one of the fastest growing chemicals world wide is a well studied application.

Dr S. D. Gomkale, Acting Director, CSMCRI, in his presidential address highlighted the achievements of CSMCRI and its activities which are linked with science at one end and the society at the other. He opined that the lecture delivered by Prof. Yadav will help CSMCRI in going nearer to industry for result-oriented interaction.

Earlier, Shri R.N. Vohra, Scientist, delivered welcome address and Shri C. Badarinath, Controller of Ad-

Dr S.D. Gomkale, Acting Director, CSMCRI, delivering the presidential address during the forty-fourth Foundation Day celebrations of the institute. Seated on the dais (*from right*) are: Shri K.D. Padia, Shri R.N. Vohra, Prof. G.D. Yadav and Shri C. Badrinath ministration, proposed a vote of thanks. The programme was organized by a committee headed by Shri R.N. Vohra, with Shri K.D. Padia as the convener.

Indian Institute of Chemical Biology, Calcutta

Indian Institute of Chemical Biology (IICB), Calcutta, celebrated its forty-second Foundation Day during 8-11 April 1997.

In his welcome address Dr Jyotirmoy Das, Director, IICB, elaborated the glorious past of the institute built from the national spirit by dedicated scientists. He also focused on the present activities of IICB and appealed to all to work harder so that the institute not only becomes a centre of excellence in basic research but also earns money by transferring state-of-the-art technologies.

Dr Das also introduced Dr Anil Ch. Ghosh, Scientist-in-Director's Grade and Dr A.K. Giri, Scientist C, and the 33 new research scholars who had joined the institute during the past year. Names of the 22 scholars who had obtained Ph.D. during the year were announced and three of them, who were still working in the institute, felicitated.

Warm felicitation was given to four employees, Shri B.N. Ghosh, Smt. Lila Chakraborty, Shri Safi Mahammed and Shri D. Sengupta, for completing 40 years of service in the institute. They were presented with mementoes and certificates of honour in recognition of their service.

Two popular lectures in Bengali, one by Dr Basudeb Achari on 'Medicines from Plants' and the other by Dr Ashes Nundy on "Internet & We" were delivered on the occasion. A video show on R&D activities of the institute, telecast earlier on the National Network in 'Turning Point' programme, was also arranged.

Other programmes included: Tenth J.C. Ray Memorial Oration; photographic exhibition-cum-competition; and a cultural programme by the members of the IICB Club, which included an interesting Quartefoil contest and a Bengali drama. At the end, Dr Das gave away prizes to the successful participants in the photographic competition and Quartefoil contest.

Sitting on the dais during the IICB Foundation Day function (*from left*) are: Dr J. Das and Shri N.C. Chakraborty; and Dr Das presenting the tenth J.C. Ray Memorial Oration Medal to Prof. R. Jayaraman

Tenth J.C. Ray Memorial Oration

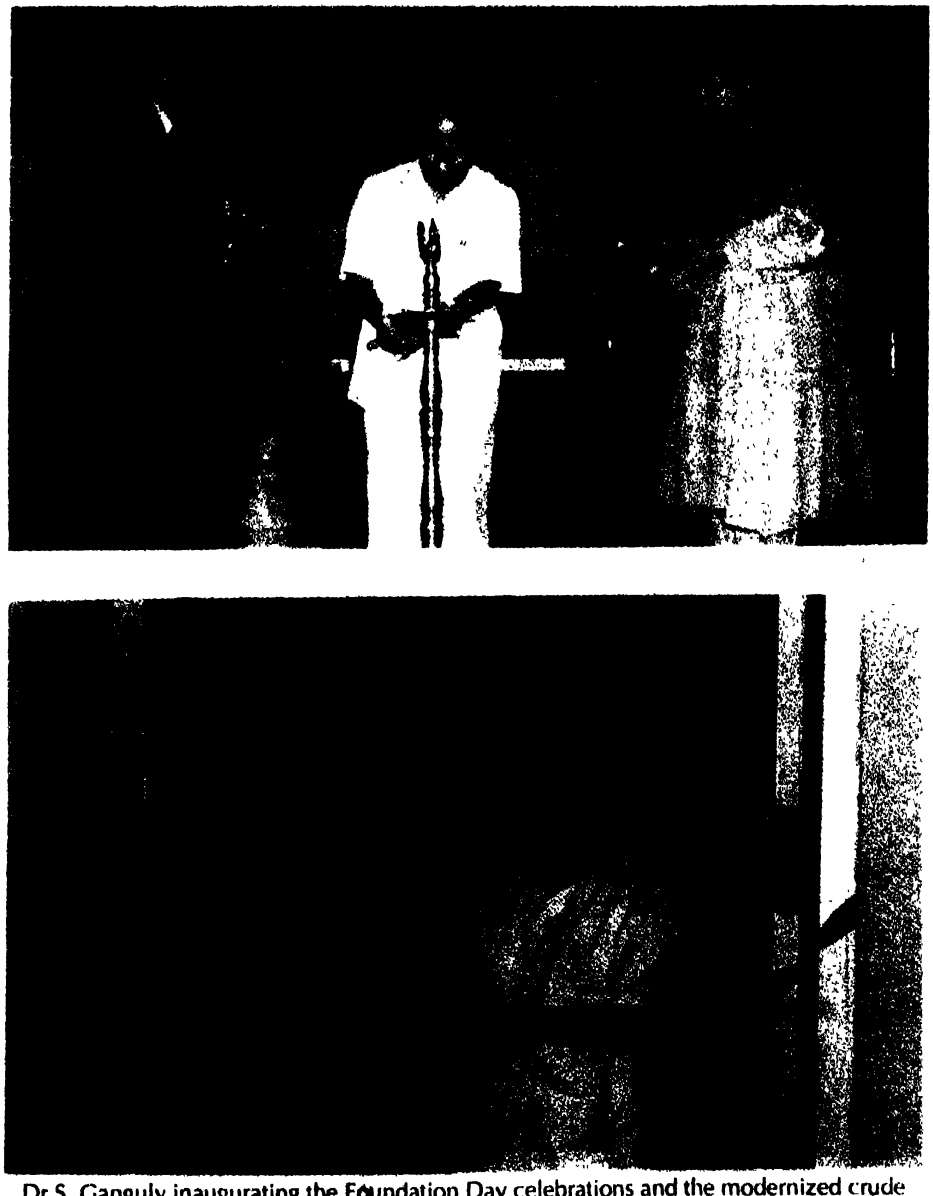
This year, the oration was delivered by Prof. R. Jayaraman, School of Biological Sciences, Madurai Kamaraj University, on the topic: 'Adaptive Mutagenesis on *E. coli*'.

At the end of oration, the speaker was presented with the J.C. Ray Memorial Oration Medal and a cash award of Rs 2500.

Indian Institute of Petroleum, Dehra Dun

The Indian Institute of Petroleum (IIP), Dehra Dun, celebrated its thirty-fifth Foundation Day on 14 April 1997.

Dr S. Ganguly, Executive Vice President of the Associated Cement Companies Ltd, was the chief guest at the function which coincides with the birth anniversary of Dr B.R. Ambedkar. Dr Ganguly, Dr T.S.R. Prasada Rao, Director and representatives of various sections of the IIP staff paid rich tributes to Dr Ambedkar



Dr S. Ganguly inaugurating the Foundation Day celebrations and the modernized crude evaluation lab of IIP. Seen at his right is Dr T.S.R. Prasada Rao.

Dr Ganguly delivered the Foundation Day Lecture on 'Collaborative Research for Technological Development: Indian Framework'. He said that Indian scientists must realize that market-driven research and development programmes are most relevant in today's competitive global scenario, and for this co-operation between scientific institutes and the industry must be enhanced. All research programmes must have economic justification, and there is no point in pursuing research ideas which have no room in the market place. He also mentioned about the acute energy shortage in India and called for carrying out cost-shared, market-driven research in all the premier scientific laboratories in the country. He expressed satisfaction to note that after de-regulation measures taken by the government, public-funded R & D institutes have come to the forefront through several market-oriented research projects. In the last three to four years there has been a great emphasis within CSIR to link research to the market place and IIP has established itself as a successful model in building relations with the industry. As a result of these efforts, IIP was poised today for major leap forward, he added.

Earlier, Dr Prasada Rao welcomed the Chief Guest and introduced him to the audience which comprised IIP staff, citizens of Doon Valley, invited dignitaries, former employees of IIP and members of press.

Dr Ganguly also inaugurated the modernized sophisticated instrumental analysis laboratory of the Crude Evaluation and Standard Analysis Division headed by Dr J.M. Nagpal. The laboratory has been recently modernized by adding new sophisticated instruments under the OIDB grant given to the institute for this purpose.

Dr Nagpal explained the capabilities enhanced by addition of these new equipment. The evaluation of crude oils is the focal activity of the institute since its inception and the laboratory has state-of-the-art facilities to cater to the needs of oil industry in this very important area.

The entire proceedings of the Foundation Day were conducted by Shri R.S. Gaharwar, a senior scientist of the institute, and vote of thanks was proposed by Shri K.K. Gandhi, Area Leader, who was the Chairman of the Foundation Day celebration committee.

Dr Prasada Rao had announced the following awards on the occasion of Republic Day: *Best Scientist* — Shri Anjum Sharma; *Best Workers* — Shri M. S. Chauhan, Shri Sudama Singh, Shri Balram Bhardwaj, Shri Dharam Pal, Shri Babu Lal, Shri Satish Kumar, Smt. B.M. Sehgal and Shri C.L. Uniyal; and Director's Award — Shri Sudama Singh and Shri Asha Ram. These awards were presented by Dr Ganguly. Five meritorious students of the IIP Kendriya Vidayalaya, Masters Harpreet Singh and Satish Nautiyal and Km Vineeti, Pratibha Rawat and Neelam, were also given awards on this occasion.

Central Mining Research Institute, Dhanbad

The Central Mining Research Institute (CMRI), Dhanbad, observed its Foundation Day on 10 May 1997. Shri R.G. Mahendru, former CMD of CMPDIL and BCCL and presently Chairman of the Advance Coal Management and Marketing (P) Limited, New Delhi, who was to present the CMRI Foundation Day Lecture, could not attend the function. His lecture was presented by Prof. B.B. Dhar, Director, CMRI.

Shri Mahendru in this lecture stressed, "Our indigenous R&D endeavours and technology may be facing greater competition from imported technology in the liberalized environment, but our imports would have to be continuously repalced by indigenous technology development for self-sufficiency". In this context, he exhorted the Indian scientists to make their R&D institutes more vibrant activity centres and endeavour to raise standards all around instead of losing the motivation and morale on account of the perceived drift.

Complimenting CMRI for its wide spectrum of activities and total R&D endeavour, he touched upon initiatives of the institute in the field of mining environment, reclamation, development of eco-friendly mining methods and raising the standards of awareness and responsibility of the present generation towards the sustained development.

Prof. Dhar who also delivered the welcome address advised the scientists to sustain the growth and progress in R&D, keep intimate interaction with the user industries and maintain close coordination amongst themselves.

He also exhorted them to develop high technology in mining and expand the area of their activities making the industry feel the importance of CMRI. They should not forget to take into account the economics in their technology, process or product — whatever it may be, because it is an important factor in the era of competition.

Dr S.K. Sarkar, Scientist F, CMRI, stressed the need for increase in R&D funds. He also advised the scientists to put more effort in Engineering Research to get rid of import of heavy and sophisticated equipment which are purchased by spending huge amount of foreign exchange. ❑

National Symposium on Catalysis

THE thirteenth National Symposium on Catalysis was held at the Indian Institute of Petroleum (IIP), Dehra Dun, on 2-4 April 1997. Co-sponsored by CSIR, DST, OIDB, CHT, IOC, BPCL, ONGC, GAIL, UOP (Asia), Condea, Fine Tech Instruments, IBP, IPCL, BRPL, MRL, CRL, Reliance Industries, MRPL, ESSAR Oil, Oil India, HOCL, GSFC, Adarsh Chemical, UCIL, SBI-IIP Branch, Chemito Instruments, DAE and Bruker India, the symposium was organized under the aegis of Catalysis Society of India (CSI). CSI is celebrating its silver jubilee this year and the present symposium formed part of these celebrations. Over 400 delegates attended.

Inaugurating the symposium, the Chief Guest Prof. M.G.K. Menon highlighted new developments in chemical techniques and technologies pertaining to the field of catalysts. He pointed out that the concept of science-based industry, which gained ground in the country only after Independence, is now widely prevalent. The science of catalysis and its practice in the country will take on newer dimensions in the coming decade as its commercial importance has now been well established beyond doubt and the challenges posed by its study will enhance its development, he added.

Earlier, while welcoming the delegates and guests, Dr T.S.R. Prasada Rao, Director, IIP, and Chairman of the National Organizing Committee of the Symposium, said that the participation of about 25 foreign experts in the Silver Jubilee Symposium of CSI was a source of great pride for the scientific community of the country. IIP had earlier hosted the symposium of CSI exactly 20 year ago, he recalled.

Dr Paul Ratnasamy, Director, NCL, Pune and co-Chairman of the Symposium, stressed the need for releasing more funds for catalysis research, which he pointed out, "had not reached the point of diminishing returns" as was believed by some people. The major fruits of the research would come to light in the future, Dr Ratnasamy added.

Briefing the audience on the history and activities of CSI, its President Dr N.M. Gupta said that the society, in coordination with CSIR and DST has played an important role in initiating several international exchange programmes in the area of catalysis.

On this occasion, CSI's 'Eminent Scientist Award' was given to Dr Prasada Rao, Director, IIP and Dr S. Sivasanker of NCL, by Prof. Menon. An impressive exhibition was also arranged where several Indian and foreign manufacturers displayed their products.

A press conference was held on the eve of the symposium, where Prof. Prasada Rao informed the media persons that technologically improved catalyst will be required to help the government meet its goal of making unleaded petrol available all over India by 1999, and for controlling the sulphur percentage in diesel, to check environmental pollution. The government was spending Rs 2000 crore to make unleaded petrol available in all parts of the country, and Rs 6000 crore will be spent by refineries to bring down the percentage of sulphur in diesel from 1.5 to 0.25 over the next two years.

The CSI President Dr N.M. Gupta said that the last three decades have seen tremendous pro-

Prof. M.G.K. Menon inaugurating the 13th National Symposium on Catalysis. Dr T.S.R. Prasada Rao and Dr N.M. Gupta are also seen in the picture gress in the field of catalysis in India, both in terms of developing indigenous catalysts as well as fundamental studies in this area. The CSI symposium and workshops have acquired international character and CSI is affiliated to the International Association of Catalysis Society, he added.

Dr G. Murlidhar, Senior Scientist at IIP and Convener of the symposium, told the press that over 400 delegates from industry, research institutes, academic institutions and over 25 foreign experts from 13 countries would be participating in the symposium which would be held in parallel sessions due to the multiplicity of the topics. Participation of foreign experts in the CSI's symposia over the years has fostered international co-operation and exchange of views, he pointed out. ❑

Roving Workshop on Patents

A WIPO-CSIR roving seminar on Drafting, Interpretation and Examination of Patent Documents, was held at the National Aerospace Laboratories (NAL), Bangalore, on 24-25 April 1997. The patent attorneys Dr Karl Rackette and Mr C. Joseph Faraci, and Mr N.R. Subbaram from the CSIR IPM Division with the occasional participation of Dr G.S. Jaiya of the World Intellectual Property Organization (WIPO), provided an illuminating two-day excursion of the world of patents: How does one prepare patent applications in biotechnology? What are exemplary claims? Why is patent information so important? What is the Patent Co-operation Treaty (PCT) and what are its implications for India? How does one file patent application abroad? What are the differences between European and American patent laws?

Dr B.R. Somashekar, Scientist, NAL, welcomed the gathering ("This workshop is a pointer to CSIR's new priorities and concerns".), Dr Jaiya communicated WIPO's keenness to collaborate with CSIR and India ("As a people, Indians are still not conscious of IPR".) and NAL Director Dr T.S. Prahlad explained why it is so important to understand the critical role of IPR ("Both to safeguard national R&D investments and compete internationally"). But the highlight of the function was the captivating keynote address by Mr Shahid Ali Khan. As a former Deputy Director General of WIPO, Mr Khan has seen it all. He explained how India's patenting policy can be used to stimulate economic growth and development. Why is it important ("like China") to remove barriers and open economies for unprecedented flow of funds'? Why should the controllers too disappear together with the controls. Why India must join international multilateral treaties? Why is it essential to encourage inventors' associations and why certain elements of our Industrial Patent Law deserve to be thrown into the Arabian Sea!

Mr Shahid Ali Khan also explained why it is important for the patenting culture to grow and take root in India ("Do you know that you can even have patents for bicycle spare parts, exhaust mufflers and velcro straps?). In short, Mr Khan's message was that it was high noon in the world of patents. Anyone who exploits its remarkable energy will ride away into the glowing evening of success. "In India, we seem to be satisfied merely gazing at the day's first approaching ray", he mused wistfully. ❑

Dr C.M. Gupta takes over as Director, CDRI

DR C.M. Gupta took over as Director of Central Drug Research Institute (CDRI), Lucknow, on 3 April 1997 after having served as Director of a sister CSIR labroatory, the Institute of Microbial Technology (IMTECH), Chandigarh, from April 1992 to April 1997. Recognized nationally and internationally for his significant contributions to the areas of Bio-organic Chemistry and Membrane Biology, Dr Gupta is the recipient of several prestigious honours and awards.

Dr Gupta (born 1 Sept. 1944, Bharatpur) obtained his M.Sc. in Chemistry from Jaipur University in 1966 and Ph.D. in Organic Chemistry for his work carried out at CDRI in 1969. Later, he worked as a Postdoctoral Fellow with Dr John G. Moffat at the Institute of Molecular Biology, Syntex Research, Palo Alto, California, during 1973-75 and as a Research Associate with the Nobel Laureate Prof. H.G. Khorana at MIT, Cambridge, USA, during 1975-78.

He joined CDRI as a Scientist in 1978 and pursued research in Membrane Biochemistry/Biophysics. He served as Head of the Membrane Biology Division. As the Area Coordinator of the programme 'Generation of New Leads', he played a crucial role in directing basic research activities at the institute. Through his early work on heterocyclic compounds containing 2-substituted-2-quinazolo-4-ones synthesized by him, he was the first to demonstrate the association between pyrimidine nucleus and antidiabetic activity. This novel discovery later formed the basis of design and development of new anti-hyperglycemic agents, ultimately leading to the discovery of a potent antidiabetic molecule 'Centpiperilone' which, however, in spite of scientific merits failed to clear as an antidiabetic drug owing to some side effects. Besides, he developed economic process technologies for some known drugs, viz. Clonidine (antihypertensive) and Indomethacin (antiinflammatory) which were later commercialized in the country by IDPL and Themis, respectively.

Dr Gupta's most significant contributions are related to the problems associated with drug delivery using liposomes. He successfully designed and developed liposomes which stayed longer in blood circulation and achieved targeted delivery of liposomized agents to erythrocytes *in vivo* by covalently attaching anti-erythrocyte $\mathrm{F(ab')}_2$ to the liposomes' surface. By using this approach, he demonstrated that the antimalarial drug chloroquine, entrapped in antibody coated liposome, can treat not only the chloroquine-sensitive but also the chloroquine-resistant malarial infections. In a follow-up study, he showed that the liposomes coated with F(ab')2 fragments of a monoclonal antibody specifically recognized the malaria-infected erythrocytes. On loading monoclonal antibody tagged liposomes with chloroquine, this drug effectively cured chloroquine-resistant malaria in experimental animals.

Besides, tuftsin bearing liposomes developed by him were found to effectively deliver the entrapped materials to the macrophages and to increase the host's nonspecific resistant to infection, like malaria, leishmania and tuberculosis. The practical utility of these liposomes was demonstrated in effective treatment of aspergillosis by liposomes loaded with amphotericin B.

In the area of phospholipid and C-nucleoside synthesis, non-availability of pure and defined chain phospholipids has been a major limitation in the use of biophysical techniques for the study of structure and dynamics in biological membranes. Dr Gupta overcame this problem by developing an efficient and simple procedure for preparation of pure glycerophospholipids; the procedure is now very popular in preparation of photosensitive, and ^{13}C and radiolabelled phospholipids. He also developed easy procedures for preparation of a number of biologically interesting phosphatidylcholine analogs and highly efficient procedures for preparing pure radiolabelled phospholipids.

Dr Gupta was the first to develop an organochemical approach to study the lipid-lipid and lipid-protein interactions in biological membranes. Photosensitive phospholipids synthesized by him have been successfully used as probes to study the cell membrane-embedded regions of integral cell membrane proteins.

To determine the factors responsible for differential distribution of various phospholipids in the two leaflets of the membrane bilayer, a number of studies performed worldwide had suggested that the transbilayer phospholipid distribution, at least in highly curved membranes, is controlled by the phospholipid polar head-group surface area and/or length. But studies by Dr Gupta clearly demonstrated that the main parameter that controls the phospholipid distribution in two monolayers of the membrane bilayer is the effective volume of the phospholipid polar head-group, rather than the head-group surface area or length.

Dr Gupta's studies on transbilayer phospholipid organization revealed that the membrane skeleton-bilayer interactions alone can not control the asymmetric phospholipid distribution across the erythrocyte membrane bilayer. Further studies on these lines finally demonstrated that both membrane skeleton - bilayer interactions and an ATP-dependent out-to-in aminophospholipid pump are required to generate and maintain the phospholipid asymmetry in native erythrocytes. While the phospholipid pump seems to be the major factor in generation and maintenance of the asymmetry, the membrane skeleton-bilayer interactions are perhaps required for stabilizing the aminophospholipid arrangement in the inner monolayer.

Apart from these studies, Dr Gupta also identified a 70 kDa protein in cytosol of the mature mammalian erythrocytes, which was similar to the well known class of 70 kDa heat shock proteins (hsp 70). This protein under normal conditions is localized mainly in the cytosol, but has strong tendency to bind the membrane under heat or pathologic stress, such as malaria infection. The binding was almost exclusively restricted to the membrane skeleton, and seemed to primarily involve the hydrophobic interactions. From these results, he suggested that hsp 70-like proteins in mature mammalian erythrocytes could perhaps play an important role in protecting the cells under stress by stabilizing the membrane skeleton through their interactions with skeletal proteins.

Recently, he has initiated some studies to analyze role of the host cell cytoskeleton in budding of the extracellularly enveloped viruses, like influenza virus. Using influenza A virus-infected MDCK cells as the model system, he has shown that this virus puts two of its proteins, viz. matrix protein and nucleoprotein, in the MDCK cell cytoskeleton, which perhaps modifies cytoskeletal dynamics by specifically interacting with the cytoskeletal actin.

Dr Gupta has published about 110 research papers in national and international journals and filed 5 patents. He is recipient of several prestigious national honours and awards namely Shanti Swarup Bhatnagar Prize (1985). The FICCI Award in Life Sciences (1994-95), Ranbaxy Research Foundation Award for Pharmaceutical Sciences (1985), INSA Young Scientists Medal in Chemistry (1974) in addition to several other awards. Besides, he has also been conferred fellowships of Indian National Science Academy, Indian Academy of Sciences and National Academy of Sciences. ☐

Training Programmes at CGCRI during 1997-98

The Central Glass & Ceramic Research Institute (CGCRI), Calcutta, will be conducting the following training programmes during 1997- 98

	Field of Training Programme	*Period*	*Course Fee*
1.	Fibre-Glass Reinforced Plastic (FRP)	21 July - 1 Aug. 97	Rs 2000
2.	Glass Melting & Processing	1-25 Sep. 97	Rs 10000
3.	Pottery Making and Decoration of Ceramic Articles	3 Nov.-28 Dec. 97	Rs 3000
4.	Application of Ceramic Coatings in Industrial and Ceramic Field	17 Nov.- 5 Dec. 97	Rs 5000
5.	Sophisticated Testing of Refractory Products	17-28 Nov. 97	Rs 5000
6.	Conventional Routine Testing of Refractory Products	17-28 Nov. 97	Rs 5000
7.	Evaluation of Physical and Mechanical Properties of Unfired and Fired Clay & Allied Ceramic Raw Materials	12-23 Jan. 98	Rs 3000
8.	Fibre-Glass Reinforced Plastic (FRP)	2-13 Feb. 98	Rs 2000
9.	Slip Casting & Mould Making	16 Feb.- 13 March 98	Rs 10000
10.	Manufacture of Refractories and Castables in Lab scale and their Evaluation	16 Feb. - 13 March 98	Rs 10000

For further information please contact: Shri B.R. Biswas, Head, Technology Application & Publicity Section, CGCRI, Calcutta, P.O. Jadavpur University, Calcutta - 700 032. Telephone: 473-5829, 3469, 3496 & 3476-7; Fax : 033-4730957 ☐

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit

Annual Subscription : Rs. 60
Editor : Dr B.C. Kashyap Editorial Assistant : Neelima Handoo Production : Kaushal Kishore Single Copy : Rs. 3.00
Phone : 5786301 Gram : PUBLIFORM Telex : 031-77271 E-mail: niscom@sirnetd.ernet.in Fax : 5787062

ISSN 0409-7467

CSIR NEWS

VOL 47 NO 12 30 JUNE 1997

NAL develops Multilevel Acoustic Calibrators for Wyle Inc., USA

THE National Aerospace Laboratories (NAL), Bangalore's Director Dr T. S. Prahlad handed over three multilevel acoustic calibrators to Mr Peter Peacock, Manager (Cargo) of the Balmer Lawrie Clearing Agents, on 28 May 1997. These calibrators (Type AC1002H) had been developed by the teams at NAL's Acoustic Test Facility of the Aerospace Electronics & Systems Division, for Wyle Inc., USA. Shri A. S. Jaynath, Director of Foretek Mktg Pvt. Ltd, the Indian agents of Wyle, was present to witness the handing over which took place in the chamber of Dr B. R. Somashekar, Chairman, Technology Marketing Group, NAL. Balmer Lawrie is to immediately freight the consignment to Wyle, USA.

A multilevel acoustic calibrator is a laboratory instrument used for calibrating microphones, sound level meters and other such instruments requiring stable and accurate sound pressure levels at discrete frequencies between 31.5Hz and 16 kHz.

NAL initially developed the calibrator for use in its own Acoustic Test Facility in 1992 (e.g. for calibrating PSLV dynamic pressure transducers) when the international supplier contracted to develop the device failed to deliver it. The special feature of NAL's calibrator is that it can develop acoustic pressure up to 160 dB at different levels and frequencies; commercially available calibrators can only go up to 124 dB, and the calibration is usually done only at a single level and frequency. So what started essentially as an import substitution project has now, after successful field tests on stability and performance, spanning nearly five years, become an exportable device.

In fact, the calibrator is probably NAL's first dollar earning hardware device. While NAL has sold the first three calibrators at a special promotional price of $3000 each, the actual cost price is expected to be more. ❑

Salt Glazed Stoneware Pipes

STONEWARE pipes or salt glazed sewer pipes are waterproof fired pipes, generally made of refractory plastic clays with a low sintering point, fired at about 1250-70°C to attain the desired strength. Salt glaze/slip glaze is applied inside and outside the pipes. The diameter of pipes range from 100 to 300mm, length of the pipe from 400 to 600mm and the thickness from 20 to 30mm.

M/s Sonya Ceramics Ahmedabad, has been producing stoneware pipes of different diameters and stoneware accessories since long in Gujarat. The unit was under BIS certification. But recently, owing to stringent requirement introduced in the revised specification, it has been facing difficulties in meeting the BIS standards with reference to the percentage of water absorption, which is 10-15% for the 4"

Dr K.N. Maiti, Scientist-in-Charge, CGCRI Naroda Centre, (right), handing over the know-how document on the production of Improved Quality Stoneware Pipes to Shri Roopeshbhai Shah, Managing Director of M/s Sonya Ceramics

pipe produced in the factory as against the required value of about 6 wt% and below.

The Central Glass & Ceramic Research Institute's Naroda Centre took up a project in November 1996 with financial support from M/s Sonya Ceramics, Ahmedabad, for the development of a suitable body composition meeting the BIS specification.

In order to develop a suitable body mix for stoneware pipes with increased maturity (water absorption below 6%) at the existing firing temperature it was essential to find some low-fusible and cheaper clays which should be available in abundance in Gujarat. A thorough search was made and three types of clays were collected for the investigation. Physical, chemical and mineralogical studies were carried out on the existing raw materials used in the factory as well as new raw materials selected for the present investigation. A few compositions were found suitable for the manufacture of stoneware pipes, meeting the specific requirements. Both the green and the fired properties determined showed significant improvement over the standard factory body mix with reference to plasticity of the mixes, green and fired strengths, and water absorption (less than 6%). An improvement in the per cent apparent porosity and bulk density of fired specimens was also noticed. Using one of these compositions, factory trial was conducted on about 1.0MT experimental body for making 4" dia pipes. The pipes were finished dried and then finally fired at about 1260°C with soaking for about 2h at the peak temperature. The trial was very successful and the properties of pipes produced conformed to the desired specification, with beautiful salt glaze on the surface of pipes.

The technology has been transferred to the sponsor. ❑

Meteorological Tower for ONGC

A self-recording weather station/meteorological tower has been developed by the National Institute of Oceanography (NIO), Goa, and installed at the Institute of Petroleum Safety and Environment Management (ONGC), Margao. The meteorological tower includes standard suite of sensors for measurement of wind speed, wind direction, air temperature, solar radiation, barometric pressure and relative humidity. The data are stored in the internal memory with storage capacity for more than three months. The serial communication link allows monitoring and retrieval of data using portable personal computer in the field.

Self-recording Wind Recorder at NIO

A self-recording wind recorder has been fabricated and installed at NIO for long-term wind measurements for climatological studies. ❑

Anti-corrosion Strippable Coating for Machined/Polished Metallic Surfaces

THE Central Electrochemical Research Institute (CECRI), Karaikudi, has developed a new strippable coating suitable for application to machined/polished metallic parts for protection against corrosion during transit and storage.

It is a cold applied liquid coating material (similar to paint) which can be removed by manual stripping just before use. The coated part also gets protected against scratch and other mechanical damages during handling. The liquid coating material can be applied by dipping/spray and it forms a coating over the substrate on air drying— the thickness of the dry film ranging from 30 to 70 microns and drying time from 5 to 30 minutes, depending upon the requirements of the user. Transparency can also be varied according to usage. It may be made fully/partially transparent, and also fully opaque.

The coating is ideally suitable for corrosion protection of machined/polished steel parts and plated parts, (gudgeon pins, bearings, valves, pistons and automobiles and cycle parts, etc.) and other engineering spares during storage and transit under industrially polluted and corrosive atmospheres or under marine conditions (ports and ships). In addition, it also provides protection against mechanical damages while handling. The manufacturer can also have a seal of his product over the coating to protect against duplication.

The dry film is very tough and resistant to many chemicals in addition to corrosion. Hence it can be used as a masking coating during electroplating/anodizing, etc., when the part is immersed in chemical solutions. It is also useful for machine tools for protecting the tip against mechanical damages, and also for surgical tools in hospitals to avoid corrosion/contamination.

The product conforms to BS 1133.

When the part is ready for use, the coating can be just cut open by nail/blade/knife at one point and the entire coating can be stripped off in a single stroke. The strippability is retained even after one year. The stripped material can advantageously be reused by dissolving in suitable solvents.

All the raw materials for manufacturing the product are indigenously available. The raw material cost for one litre may figure around Rs 60-80 per litre, depending upon drying time and thickness requirements. It may easily be sold in the range of Rs 120-140 per litre.

It is an innovative product for the Indian market and has a great market potential with a handsome profit margin. ❑

Processes licensed and sponsored/ consultancy projects taken up by CECRI

THE Central Electrochemical Research Institute (CECRI), Karaikudi, has licensed its process for extraction of gallium metal to NALCO, Bhubaneswar (Lump sum Premium: Rs 2 million, Recurring Royalty: 2.5%, Consultancy Fee: Rs 1 million).

The sponsored projects taken up by the institute include:(i) Electrochemical treatment of effluents from hydrogen peroxide plant; UDHE India Ltd, Mumbai (Rs 169,000); (ii) Development of paint formulations for concrete/steel samples in wet and under water conditions; Krishna Conchem, Mumbai (Rs 450,000); and (iii) Corrosion control by microorganism, DST; New Delhi (Rs 737,000).

The consultancy projects taken up include: (i) Assessing the quality and soundness of the ferrocement panels; Matrimandir, Auroville (Rs 182,500); (ii) Inhouse training on electroplating; Patel Brass Works, Rajkot (Rs 61,750); (iii) Inhouse training on lead-acid batteries; Centre for Entrepreneurship Development, Bhopal (Rs 65,000); and (iv) Decorative gold plating of ornamental pieces; Guruvayurappan Fancy Stores, Guruvayur (Rs 25,000).

Technical services taken up relate to: (i) Electropolishing of grids used in colour television; Samtel Electron Devices, Ghaziabad (Rs 15,000); and (ii) Fabrication and supply of 100 nos. of magnesium silver chloride batteries; Aeronautical Development Establishment, Bangalore (Rs 75,000).

Plant Commissioned

Membrane Cell: A project on 'Development of Membrane Cell Technology for Chlor-Alkali production was sponsored by TIFAC, DST, New Delhi. The pilot plant for production of caustic soda based on the latest technology developed by CECRI has been commissioned successfully. ❑

Modernization of Clay Roof Tile Industry at Morbi

THERE is a major concentration of clay roof tile units at Morbi in Gujarat, which have been producing traditional types of unglazed roofing and decorative facing tiles since a few decades. The life and performance of these products are quite poor owing to the substandard quality of products, and the units are becoming less economical because of low productivity, availability of different and newer types of roofing materials, and shrinking market.

To bring about improvement in the productivity and quality of roof tiles as well as diversification in the product mix, the Naroda Centre of Central Glass & Ceramic Research Institute (CGCRI) sometimes back took up a project for the development of suitable glossy & matt glazes for the roof & decorative facing tiles being produced at Morbi. The basic aim was to improve the status of the roof tile industry through the production of diversified products and thus, opening up new avenues in the internal and external markets.

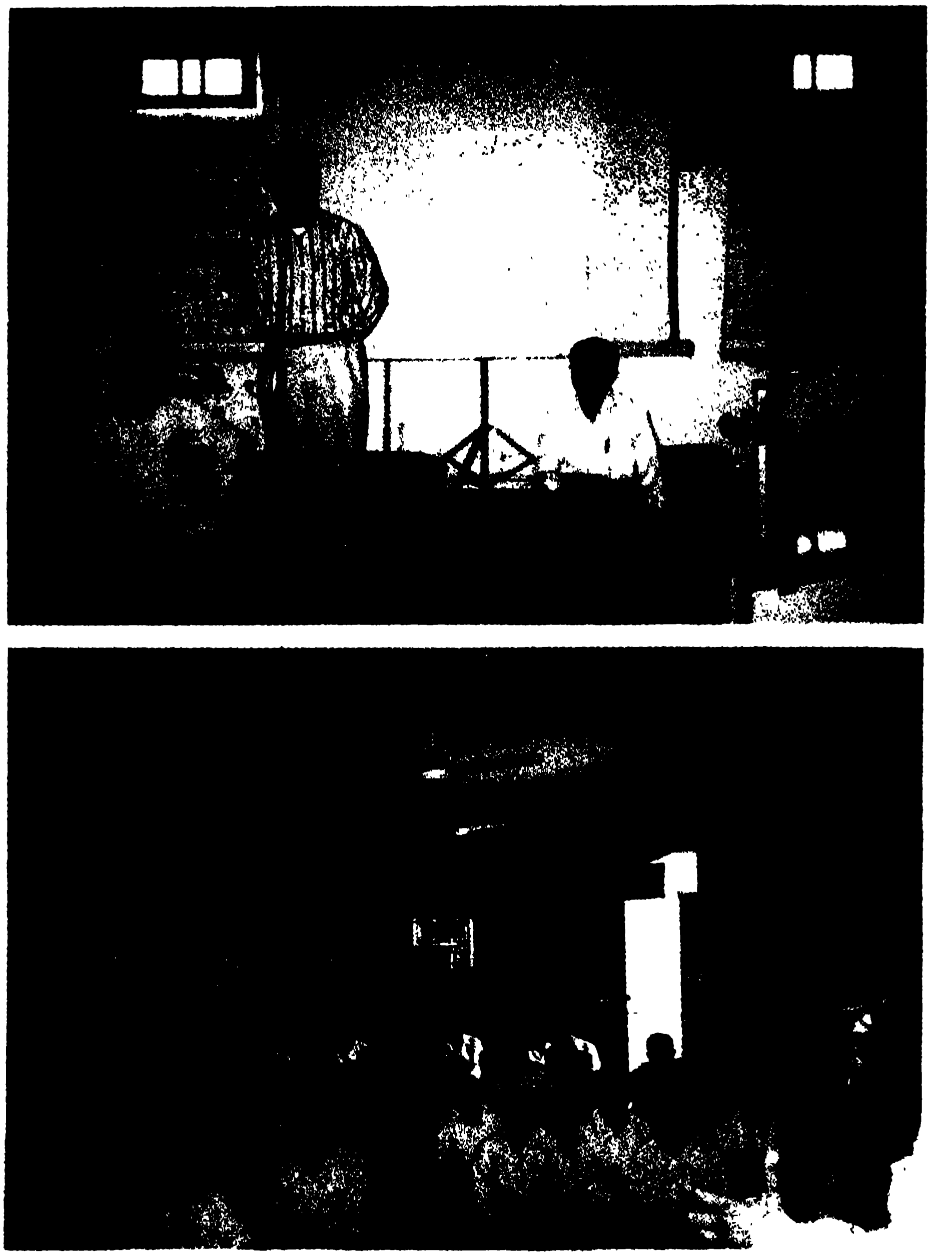
The project involved assessment of quality of the existing products through the study of various parameters such as % water absorption, % apparent porosity, bulk density and thermal expansion; development of suitable low-temperature frits; production of appropriate engobe, transparent & coloured glazes; and optimization of their properties.

The unglazed roof & decorative facing tiles manufactured at Morbi are fired in the range of 950° - 1000°C and frits & glazes suitable for these products should also mature at about the same temperature. The development of such type of glazes necessitates the use of low temperature frits.

The surface of the roof tiles produced at Morbi, on which glaze is to be applied, is rough, uneven and full of pinholes and craters and lime spots coupled with non-uniformity of water absorption. Direct application of the glaze on to the surface of such a tile creates defects like pinholes, blisters, shade variation in colour glazes and non-uniform application of the glaze. It is, therefore, quite essential to apply a buffer layer, called 'engobe' prior to the glaze application. Engobe covers up the undesirable body colour, the surface defects of the roof tiles, creating even coating for uniform application of the glaze as well as imparting uniform colour shades in the glazed products.

In view of the limitations in keeping the tile body constant and achieve optimum fluidity and maturity of the glaze at low temperature, suitable low melting borosilicate frits, engobe and glossy as well as matt glazes were developed as per the requirements. The fired roof & decorative tiles procured from the market were engobed and then glazed in both glossy & matt glazes. These were fired in an electric kiln at about 1000°C with one hour dwelling time at the peak temperature.

The fired glazed tiles in glossy and matt glazes were found to be of excellent quality and with increased mechanical strength. These were attractive and free from defects. Further, no expensive raw materials were used for development of frits & glazes.



Top: Dr C. Ganguly, Director, CGCRI, delivering his concluding remarks at the workshop on Modernization of Clay Roof Tile Industry at Morbi. Seated on the dais are Dr K.N. Maiti, Scientist-in-Charge, CGCRI Naroda Centre (*right*) and Shri Prabhubhai Patel, President, Morbi Roofing Tile Association. *Above:* A section of participants of the workshop.

Workshop

With a view to disseminating information regarding the technology among the roofing tile industry at Morbi, a one-day workshop was organized on 23 April 1997 by this institute in close co-operation with the Roofing Tile Manufacturers' Association of Morbi.

Dr C. Ganguly, Director, CGCRI, in his address, highlighted the significance of the R&D activities with which roofing tile industries should associate themselves for the betterment and diversification of their products. He also emphasized the urgency to improve the quality of roofing tiles produced in Morbi through R&D before foreign companies find market in India.

In his keynote address, Dr K.N. Maiti, Head, Traditional Ceramics & Rural Technology and Scientist-in-Charge of CGCRI, Naroda & Khurja Centres, dwelt on the technological status of roofing tile industries of India vis-a-vis global scenario. He highlighted the technological stagnation in roofing tile industries in India and the advances and innovations made in foreign countries like Italy, Germany and UK. He also discussed in detail the advanced methods, processes & equipment and the type of kilns, used in the manufacture of roofing tiles abroad.

Shri H.M. Shah, Technical Officer, delivered a lecture on the development of the processes for frits, engobe as well as glossy and matt glazes. Shri R.M. Savsani, Technical Officer, spoke on the physico-chemical characterization of common clays as well as the fired properties of clay roof tiles manufatured at Morbi.

Shri Prabhubhai Patel, the President, Morbi Roofing Tile Manufacturers' Association, expressed his happiness over the efforts made by CGCRI's Naroda Centre for the upliftment of roofing tile industries at Morbi. Shri Chandrakantbhai Aahar, ex-Secretary and a Member of the Association, expressed his deep gratitude for the interest shown by the Centre for the upgradation of roofing tile industries of Morbi.

Around 50 participants representing roofing tile industries at Morbi attended the workshop. ❑

REGIONAL RESEARCH LABORATORY, BHUBANESWAR

R&D Highlights: 1996-97

WITH emphasis on generating close linkages with the various government agencies and industrial units, the Regional Research Laboratory (RRL), Bhubaneswar, carries out its R&D activities in the following areas: mineral processing, extractive metallurgy, waste utilization, inorganic chemicals, drugs, pharamaceuticals and perfumeries from forest and marine resources, design and project engineering, bioconversion of agro wastes for energy generation, rural development and environmental monitoring, agrotechnology, information technology and other areas. During 1996-97, the laboratory worked on 92 R&D projects, of which 52 projects were continued from the previous year, and 40 new projects were initiated during 1996-97. These 92 projects include 18 in-house projects (4 major laboratory projects and 14 other laboratory projects), 36 grant-in-aid projects, 31 consultancy projects, 4 sponsored projects and 3 collaborative projects.

The externally funded projects completed during the year include: (1) Setting up of a plant tissue culture R&D laboratory at Bhubaneswar. (M/s JBS Capacitors Ltd, Rasulgarh, Bhubaneswar); (2) Preparation of feasibility report for abatement of pollution caused by chromite mining and processing industries in Orissa, (M/s Orissa Environment Programme, Indo-Norwegian Development Cooperation, Bhubaneswar); (3) Bench and pilot scale studies for pneumatic transportation of -6mm & -20 mm coal and design of pneumatic conveying system of 80 TPH capacity to a distance of 400 m (M/s Talcher Thermal Power Station, Talcher); (4) Development of process technology for production of superfine and white alumina trihydrate (ATH) by chemical route (M/s National Aluminum Company, Bhubaneswar); (5) Flowsheet development for recovery of molybdenum, copper, nickel as byproducts from Jaduguda ore (M/s Uranium Corporation of India, Jaduguda); (6) Basic studies on use of plasma for smelting of ferro-manganese [M/s S RDCIS (SAIL), Ranchi]; (7) Studies for developing process for preparation of DRI fines using fluid bed technique (M/s National Mineral Development Corporation, Hyderabad); (8) Preparation of preliminary feasibility report for setting up of a sodium dichromate plant of 3 tonnes/day capacity based on RRL-B technology (M/s Metro Metals and

Chemicals, Bhubaneswar); (9) Decarburization of pig iron (M/s Electro Steel Casting Ltd, Calcutta); and (10) Development of prototype solar dryer for groundnut and other oilseeds (M/s Orissa State Seeds Corporation).

In addition, 14 in-house projects, one grant-in-aid project, nine consultancy projects and one collaborative project were successfully completed. The in-house projects completed pertained to: Development of calibration standards, Design ,and fabrication of continuous distillation unit, Study of pesticidal and surfactant properties of Moringa and Sapindus species, Utilization of spent catalyst from fertilizer plant for nickel recovery, Recovery of metal values from Rajpura-Dariba mine tailings, Mineralogy and geology of gold bearing rocks of Keonjhor district, Smelting reduction of iron ore-influence of sulphur on reduction kinetics, Nanocrystalline materials of SIC and WC, and Information database for the processes developed at the laboratory.

A few of the important projects in progress are: Development of indigenous column flotation technology at Dariba plant; Flow sheet development for improving the recovery of molybednum, copper and nickel as byproduct from Jaduguda uranium ore; Environmental data generation for Bharatpur and Kalinga areas, Talcher; Improvement in dewaterability of industrial sludges; Improvement and performance evaluation of hydrocyclone at Meghatuburu iron ore washing plant; Development of water purification system for drinking water by magnetic carrier technology; Coal beneficiation and slurry utilization, and Deinking of news papers using flotation technique for recycling.

Execution of a Memorandum of Understanding between CSIR and Hindustan Zinc Limited to establish a technology proving plant for extraction of nickel from chromite ore overburden of Sukinda region has been a successful milestone for the laboratory. It is expected that the plant will come up with the technology developed by some of the CSIR laboratories, with RRL-Bhubaneswar as the nodal agency, for extraction of nickel from these overburden material.

Performance Indicators 1996-97

R&D Projects	
(i) In-house :	18
(ii) Grant-in-aid :	36
(iii) Consultancy :	31
(iv) Sponsored :	4
(v) Collaborative :	3
Papers Published	
(i) Foreign Journals :	126
(ii) Proceedings :	52
Papers Presented :	57
Technical Reports :	56
Books :	7
Patents	
(i) Sent For Filing :	13
(ii) Filed :	2
(iii) Alive :	47
Budget :	Rs 68.383 million
ECF:	Rs 16.640 million

The Fly Ash Mission of the Technology Information, Forecasting and Assessment Council (TIFAC), Department of Science & Technology, Government of India and the Orissa Environmental Programme (Indo-Norwegian Development Cooperation) have funded the extensive R&D work on utilization of fly ash for making aggregates and cement clinkers for various construction purposes.

In the area of pollution monitoring, a major achievement was the submission of a report to the Paradip Port Authority, based on detail investigations on environmental impact assessment on handling of thermal coal at Paradip.

The other major activities/accomplishments of the laboratory during 1996-97 include:

Aromatic and Medicinal Plants

The activities pertaining to survey, introduction and cultivation of aromatic, medicinal and spice plants were continued. The third and fourth volumes of the book *Flora of Orissa* have been brought out, completing the consultancy project financed by the Orissa Forest Development Corporation, Government of Orissa. Six more plantations of *Grevillea pteridifolia, Bixa orellana*, Cinnamon and Palmarosa have been raised under the Major Laboratory Project (MLP) on Research and Development for wasteland development in four different types of wastelands besides maintaining the eight plantations raised last year. Pot culture studies on fly ash and red mud, have shown that the fly ash-soil combinations lead to better growth of aromatic plants as compared to the control (soil alone). Sabai, vetiver and jamrosa have shown encouraging growth in the combination consisting of red mud 25% and fly ash 75%. In the tissue culture studies on salt tolerance, palmarosa cell lines tolerant to salt stress up to 1.8% of NaCl have been selected through *in vitro* culture of callus. Somatic embryogenesis in selected salt tolerant lines have been achieved and first batch of regenerated plants transferred successfully to the green house. Higher yield of 5-6% bixin (food colouring material) has been obtained from *Bixa orellana* seeds using a mixture of chloroform and alcohol, compared to single solvent extraction. *Cola nitida*, which was introduced from Ghana into the Aromatic and Medicinal Plants garden earlier, has flowered and set fruits with viable seeds. The seedlings have been planted for further study. Agronomic and basic studies on *Ocimum* species, Patchouli, Ambrette, Vetiver, *Kewda*, *Simarouba* and rubber are in progress. Palmarosa, lemongrass, citronella and cinnamon have been grown over an area of 10 ha for production and distribution of quality planting materials. Two training courses on cultivation and distillation of aromatic and spice crops were conducted to promote their large scale cultivation in rural areas.

Central Physico-chemical and Analytical Facilities

Analysis and characterization studies were carried out on 4342 samples. A grant-in-aid project on 'Impact and prediction of heavy metal pollution in and around iron ore mines of Orissa' was completed. Substantial work was carried out on another grant-in- aid project on 'Reduction of phosphorus content of high phosphorous manganese ores'. A laboratory project on 'Development of standards and characterization of material', was completed and considerable progress was made on another laboratory project on 'Development of newer analytical/characterization methods'. Under the Multi-laboratory Project on Indian Reference Material (IRM), contributions were made towards developing one single-element and one multi-element standards. Basic research work was carried out on: Chemistry of tetraphenyl arsonium halochromates; Kinetics of chlorination of nickel oxide and nickel-bearing laterite ores by gaseous HCl; Kinetics of the reduction leaching of manganese nodules in dilute HCl in presence of pyrite; Electrochromic thin films; Rare earth-based phosphorus; and Iron rust. A pantent on 'Improvements in or relating to the preparation of high pure iron oxide (HPIO) for soft ferrites from complex iron solutions was sent for filing.

Design and Project Engineering

Four in-house, eight grant-in-aid and five other externally- funded projects of national and regional importance were pursued. For the Orissa Mining Corporation (OMC), an engineering consultancy assignment was undertaken for setting up a 75 tonnes per hour iron ore crushing and screening plant at Barbil. Also, in addition to the modification of an existing 100 tonnes per hour crushing and screening plant, engineering consultancy work was undertaken for the design, manufacture and commissioning of a 800 tonnes/h apron feeder for the iron ore handling plant at Daitari. Basic design for a pneumatic conveying system for the crushed bath was completed for the National Aluminium Co. Ltd (NALCO). In addition to this, the design and development of multi-purpose cook stove-cum-room heater was completed for the Government of Arunachal Pradesh. The work on National Programme on Improved *Chulhas* (NPIC) under the Ministry of Non-Conventional Energy Sources (MNES), Government of India, was continued. The programme has attracted nation-wide attention. Many low-cost agricultural devices such as paddy thresher, winnover, etc. have been developed and propagated in different parts of the country under the rural development programme of CSIR. Under the Technology Mission on Oilseeds and Pulses (TMOP), work was continued on 'Development of improved techniques and equipment for post-harvest processing of traditional and non-traditional pulses'. Under the Rajiv Gandhi Rural Drinking Water Mission, a novel water purification system using mangetic carrier/tag techniques has been developed. R&D work was continued on laboratory projects on 'Coal beneficiation and slurry utilization' and 'Development of high frequency dielectric heating device for grain drying'.

Forest and Marine Products

Under a DOD-supported project, 31 marine organisms were collected from a newly identified 30 km stretch of rocky bottom near Gopalpur, Orissa. Thirty extracts of these organisms were sent for screening to CDRI, IICT and NIO. Two of the extracts have been sought for further screening for post-coital contraception and uterine contraction. Attempts were made to study the antifouling potentialities of sedentary organisms of the Orissa coast. Metabolites of sponges, gorgonians, soft corals and antipatharians were tested against marine fouling bacteria, microalgae, cyprids of Balanus and the mussel, *Perna virdis*. Of the 170 combinations worked out, 57% showed activity; gorgonians showed the maximum activity (70%) and the soft corals the lowest (44%). *E. complexa* and *P. simplex* inhibited all the foulers tested. The extracts did not cause any irreversible damage to the cells of microfoulers. Also, active ingredients of *kendu* leaves were isolated and identified; some of these are reported to have anti-cancer and anti-inflammatory activities.

Hydro- and Electro-metallurgy

The project on polymetallic nodules continued to attract maximum importance. The other important projects included: (i) recovery of nickel metal from waste catalyst. (ii) recovery of cobalt metal from super-alloy scrap, (iii) preparation of feasibility report on extraction of nickel from chromite overburden of Sukinda region, Orissa. The two international projects being pursued in this area are: (i) Use of waste SO_2 with Murdoch University and A.J. Parker Cooperative Research Centre for Hydrometallurgy, Australia, and (ii) Bioleaching of sulphur from coal, with Polish Academy of Sciences, Poland. During the year visitors from Australia, Poland, and Germany came to the laboratory and Dr G.K. Das, Dr B.R. Reddy, Dr S.C. Das, Mr L.B. Sukla, and Mr I.N. Bhattacharya from the Division visited Australia, France, Belgium, Poland and Germany respectively. Also, professional contacts were established with CNRS, France, and University of Brussels, Belgium.

Inorganic Chemicals

Extensive R&D work was carried out in the areas of catalysis, environmental monitoring, waste utilization salt and marine chemicals. Manganese nodules obtained from the Indian Ocean have been found to be catalytically active in the conversion of long- chain thiols to bisulphides and in the oxidation of alcohols to aldehydes. Sulphated zirconia and nickel-promoted zirconia were examined as catalysts, and found to be suitable for isomerization of butane, Pillared clays and novel layered oxides are being developed as catalysts. As a part of the environmental monitoring programme, work was carried out on 'Assessment of selenium released into atmosphere by thermal power plants'; 'Impact of - chromite mining on air and water quality in adjoining areas and treatment of polluted mine water'; 'Green house gas fluxes'; and Acid-rain evaluation. Different waste materials like fly ash, red mud and alum sludge were investigated for recovery of valuable chemicals or for treatment for disposal. Refractory grade (+99% MgO) magnesia was successfully produced from bittern. Studies on scale-up of the process are being taken up with participation from industry.

Mineral Beneficiation

In addition to mineral process flow sheet development, efforts were continued in the field of mineral science and engineering through active participation in a number of projects for various industries. Keeping the global challenges in view, activites were also reoriented towards solving problems related to treatment of very lean and complex ores, including wastes, to meet the rigid specifications of the industries. In view of government's new stringent policy on environment, further R&D work was carried out to solve some of the problems related to environmental issues of the coal mine in Orissa. The various consultancy, sponsored, including major and other laboratory projects included: (1) Externally funded projects on 'Development of indigenous column flotation technology at Dariba plant', 'Flow sheet development for improving the recovery of molybdenum, copper and nickel as byproducts from Jaduguda uranium ore', 'Environmental data generation for one year at Bharatpur and Kalinga areas', 'Improvement in dewaterability of industrial sludges and 'Improvement in performance of hydrocyclone at Meghatuburu Iron Ore Washing Plant; (2) Inter-disciplinary Project on 'Development of water purification system for drinking water by magnetic carrier technology' and 'Sample preparation and pilot study related to manganese nodules'; and (3) Laboratory Projects on 'Coal beneficiation and slurry utilization' and 'Deinking of newspapers using flotation technique, for recycling'.

Mineralogy and Metallography

Characterization studies were carried out on off-grade manganese ores of Sundargarh and Koraput districts of Orissa and Vizianagaram district of Andhra Pradesh. Significant contributions were made towards implementation of the environmental monitoring projects like Coastal Marine Pollution Monitoring, Eastern Ghats Ecosystem and Environmental Impact Analysis (EIA) studies at Paradip port, National Thermal Power Corporation

(NTPC), Talcher, etc., all of which brought considerable cash flow to the laboratory. Assistance was provided to organizations like Industrial Development Corpoation of Orissa Ltd (IDCOL), Infrastructure Development Corporation of Orissa (IDCO), Orissa Mining Corporation (OMC), etc. in testing and analysis of some of their products and materials. Constant interaction with the Directorate of Mining and Geology and Orissa Pollution Control Board, Government of Orissa, has helped in implementation of the mineral and environment-based projects in this Division. The first-five year input under Coastal Ocean Monitoring and Prediction System (COMAPS) project has brought recognition to the laboratory by making the Department of Ocean Development (DOD) unit a permanent establishment under this laboratory, for which building and all the infrastructural facilities are being provided.

Pyrometallurgy

R&D investigations were carried out on several important projects in collaboration with Board for Research in Nuclear Science (BRNS), Mumbai; M/s Electro Steel, Calcutta; M/s Emami Paper Mills, Balgopalpur; M/s Orissa Mining Corporation Ltd, Bhubaneswar; and M/s Metro Metal Chemical Pvt. Ltd, Bhubaneswar. The major projects in the area include : (i) Reduction roasting of oxidic nickel ore in fluidized bed, (ii) Decarburization of pig iron, (iii) Upgradation of manganese ore and removal of phosphorus from high iron and high phosphorus manganese ore of Nishikhal Mines, Orissa and (iv) Treatment of black liquor from pulp and paper Industries to environmentally acceptable limits. The Laboratory Projects under investigation include: Processing of complex/lean ores, Industrial wastes & effluents for recovery of metal values, and Studies on direct reduction of chromite overburden using solid fuel as reductant. Basic research work being carried out pertains to 'Foaming behaviour and kinetics of FeO reduction in molten slag by solid carbon as reductant'. Also, service was provided to a private party for carrying out techno- economic viability of a process for production of sodium dichromate using down draft sintering process, for setting up of an industrial unit of 3 tonnes/day capacity. Also, extensive work is being carried out on utilization of fly ash for making aggregates and cement clinkers for various construction purposes. These activities are supported by Flyash Mission of the Technology Information, Forecasting and Assessment Council (TIFAC), DST and Orissa Environment Programme. This year, a scientist of the Division visited Cuba for a period of 15 days to study the Multiple Hearth Furnace facility for the production of nickel laterite using reduction roasting followed by ammonia leaching process. The visit was sponsored by the German Agency for Technical Cooperation (GTZ), Germany.

Special Materials

Negotiations were held with various industries for technology transfer of the laboratory's two important processes, viz. (i) preparation of fused tungsten carbide and (ii) production of zirconia from zircon. Both the above processes utilize thermal plasma technique. Molybdenum carbide and ferro-molybdenum were prepared with dissociation of molybdenite. It has been possible to prepare ferro-molybdenum with 40-50 wt% molybdenum. Process parameters and composition have been optimized to obtain fairly good reproducibility for the preparation of fused tungsten carbide with microhardness of the order of 3000 VHN. It was possible to dissociate zircon sand at a rate of 9-10 kg/h with a degree of dissociation of 80-85%. S.G.iron with hardness ~350 VHN, UTS 87 kg/mm^2 and elongation 6.25% was prepared from blue dust supplied by the Research and Development Centre for Iron and Steel (RDCIS), Ranchi. The laboratory was also engaged in carrying out R&D activities on utilization of ilmenite sand of east coast and prereduced ilmenite sand of Kerala coast. It is also participating in the preparation and characterization of nanomaterials, utilization of ferro-manganese slag and assessing the environment effect at Paradeep port. ❑

One pot synthesis of thymol

THYMOL is a main constituent of several important oils belonging to Labiate family, e.g. oil of thyme (*Thymus vulgaris*) and *ajowan*. It possesses powerful antibacterial, antiseptic and disinfectant properties and is employed in oral and gastro intestinal preparations. A novel highly efficient one pot synthesis of thymol has been recently completed at the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow. The process is being patented. ❑

National Information Centre for Marine Sciences (NICMAS) at NIO

THE National Institute of Oceanography (NIO), Goa's library has been recognized as the National Information Centre for Marine Sciences (NICMAS).

A brief information regarding various databases and services available at the Centre are given below:

INTERNATIONAL DATABASES

ASFA on CD-ROM

Aquatic Sciences and Fisheries Information System ((ASFIS) is a co-operative effort of FAO, IOC, UN/DOALOS, UNEP and ASFIS national partners. ASFIS produces *Aquatic Sciences & Fisheries Abstracts* (ASFA). The ASFA database covers bibliographic records and abstracts on science, technology and management aspects of aquatic environments, in over 40 languages. It holds 3,00,000 ASFA database records on CD-ROM from 1978 and is updated quarterly. Literature search on keywords, authors, specific geographic areas, etc. can be made.

NIO library, designated as ASFIS National Partner for ASFA database from 1990, monitors Indian literature on marine, brackish and freshwater environments for its input to the database.

Current Contents on Diskette (CCOD)

This database is one of the current awareness products available in seven editions from the Institute for Scientific Information (ISI, USA). NICMAS subscribes to the following three multidisciplinary editions:

Agriculture, Biology and Environmental Sciences (with abstracts)

Physical, Chemical and Earth Sciences (with abstracts)

Engineering, Computing and Technology.

More than 3000 journals of international repute are scanned and reported weekly.

PATSCAN on CD-ROM

It is a single source of information on US patents, published by Derwent Publishers. It is being subscribed by NICMAS from 1993.

NATIONAL DATABASES

NUCSSI on CD-ROM

The National Union Catalogue of Scientific Serials in India (NUCSSI) is a cooperative effort of major Indian libraries. It is the best source for speedy acquisition of information not readily available at NICMAS. The database covers more than 35,000 scientific serials of over 800 libraries.

OCEANLINE

This provides an Online Public Access Catalogue (OPAC) of the holdings of NIO on books, technical reports, conference proceedings, etc. It helps the search through author, title keyword, classification number, etc.

NIOPUB

This up-to-date database provides bibliographic details of over 2,500 contributions made by NIO scientists.

INDOCEAN

The database, which is under compilation, includes bibliographic citations of all the published literature on the Indian Ocean from original sources. Anyone wishing to include their publications on Indian Ocean (and adjacent waters), in INDOCEAN may send their reprints/documents to NICMAS. Presently, it holds 5000 records to which about 50 records are added daily.

SERVICES

NICMAS offers the following services at nominal costs, based on:

1. Individual requirements
2. Institutional requirements
3. Corporate requirements.

While the first two services are self explanatory, the third one is a tailor-made service. ❑

Indo-US Workshop on Ground Improvement Using Geosynthetics

A three-day workshop on 'Ground Improvement Using Geosynthetics' was organized by Central Road Research Institute (CRRI), New Delhi, in collaboration with the University of New Orleans, Louisiana, USA, under the Indo-US Collaborative Programme in Science and Technology, from 26 to 28 March 1997. The workshop was inaugurated by the Union Minister of Surface Transport, Shri T.G. Venkataraman.

Shri Venkataraman in his address mentioned about the various statutory steps taken by the government, e.g. early land acquisition, simplification of environment clearance procedures, adoptation of guidelines for private sector participation, and acceptance to share some of the risks of the private sector.

The Hon'ble Minister said that allocation of an additional sum of Rs 5000 million to the sector in the 1997-98 budget bears ample testimony to the government's resolve to accelerate the pace of National Highway development. The National Highway Authority of India has been directed to develop the four corridors linking the megapolis of Delhi, Calcutta, Chennai and Mumbai, as well as the linkages to the ports. These four-lane corridors would be made by either engaging the private sector through build, operate and transfer (BOT) scheme or through budgetary support. He informed that BOT scheme would be made more viable by permitting the entrepreneur to collect toll on adjoining sections completed through budgetary sources. The World Bank is also assisting in carrying out model studies for optimizing our maintenance operations. This would need an innovative approach wherein our people would also have to be trained for fully utilizing them in the operations. "The new materials like geosynthetics which have been found highly effective for stabilizing roads will be encouraged by the government in the construction of new highways", he added.

Speaking on the occasion, Dr A. K. Gupta, Director, CRRI, said that this workshop would review the engineering applications where geosynthetics have been successfully used and evaluate their compatibility and usefulness in USA with similar needs existing in India.

Shri A. D. Narain, Director General, Road Development and Addl. Secretary, Ministry of Surface Transport, expressed hope for better Indo-US cooperation in the field of construction of highways and exchange of technology between the two countries.

Addressing the workshop, the Department of Science & Technology's Secretary Prof. V. S. Ramamurthy highlighted the importance of technology in the road sector. He also inaugurated an exhibition on geosyntethic materials in which manufacturers from India and abroad participated.

Shri T.G. Venkataraman, Union Minister of Surface Transport (*left*), in discussion with Prof. A.K. Gupta, Director, CRRI, during the Indo-US Workshop on Ground Improvement Using Geosynthetics

About 150 S&T experts from diverse fields, i.e. highway engineering, soil engineering, and manufacturers discussed the issues in four technical sessions. This workshop provided a forum for dialogue between those looking for solutions to India's needs in this important area with the most current technical advances in American technology. ☐

National Seminar on Use of Hindi in Computer Science

A three-day National Seminar on the Use of Hindi in Computer Science was organized by the Official Language Section of the Indian Institute of Petroleum, Dehra Dun, with the co-operation of the Commission for Scientific and Technical Terminology (CSTT), Department Education, Ministry of Human Resource Development, Government of India, from 26 to 28 May 1997. A large number of computer scientists, linguists, lexicographers, educationists, etc. from different parts of the country attended the seminar.

Inaugurating the seminar, Dr G.P. Vimal, Director, Central Hindi Directorate, New Delhi, stressed that Hindi, spoken by the majority of Indians, should be strongly connected with the world of computers since they were now "an integral part of progressive life". The development of computer language in Hindi is need of the hour as the Hindi-speaking world must not lag behind in this age of "Information Technology" or "Infotech" and "information- without-delay", he added. Prof. Suraj Bhan Singh, Ad-

Dr D.D. Nautiyal addressing the National Seminar on Use of Hindi in Computer Science

viser, Centre for Development of Advanced Computing (C-DAC), Pune, said that computers had revolutionized the field of language and linguistics as language had to, perforce, become not only the tongue of man but that of machine as well. He also highlighted the urgent need to promote the use of Hindi in computers and to develop Hindi terminology which would meet the needs of daily use and could face the market forces. Shri S.P. Gera, Controller of Administration, IIP, opined that computers were the backbone of progress. Dr T.S.R. Prasada Rao, Director, IIP, while welcoming the delegates said that due to the prevalent use of English in the background of continuing British influence in India, computer technology still has not been well-merged into the national fabric and that promoting the use of our own languages in computers was a very welcome idea. More so for Hindi, since this language is closest to the hearts of the Indian people.

Prof. P.S. Saklani, Chairman, CSTT, said that the Commission was doing important work in the field of terminology, especially the computer terminology, since computers were now "man's second nature". The Comission was also preparing floppies in Hindi. He opined that science in Hindi was not only required to be done in Hindi but it should be Indianized as well.

Mentioning the major contributions of CSTT, its ex-Secretary Dr D.D.Nautiyal said that the Commission had not only imparted much life force to the Hindi language by providing it lakhs of technical terms but it has also fostered the cause of other Indian languages by providing sizeable financial aid to the states for the promotion of their respective state languages.

Dr D.C.Chamola, Hindi Officer, IIP, and Local Organizer of the seminar, said that Hindi had progressed to a considerable extent through science writing in that language and this in return, would help in taking science to a much larger cross-section of the masses.

Shri M.C. Ratori of the Official Language Section proposed a vote of thanks. A special issue of the institute's Hindi magazine *Vikalp* was also released on the occasion.

The inaugural session was followed by lectures on 'Computer: Research and Analysis'. by Dr P.B. Semwal of IIP and Ms Shuchita Upadhyaya of the Kurukshetra University.

On the second day, the Hindi-Burmese litterateur, Shri C.P. Prabhaker underlined the use of computers in various fields like agriculture, education, music, films, etc. while Dr Alok Saxena of IIP stressed on the need to establish coordination among the experts in Hindi and computers. Dr Ram Avtar Singh of BHU focussed on error analysis. Dr Ashok Kumar of the Kurukshetra University said that the use of Hindi in computer science was need of the hour and that books on computer science should also be made available in Hindi. Prof. Naresh Mishra of the Maharshi Dayanand University, Rohtak, talked about spelling and terminology, and said that it was necessary to bring about necessary changes in the *Devanagari* script in order to accommodate the use of Hindi in computers. Shri T.P. Pathak of NISCOM, New Delhi, while presiding over the session, stressed that computer science should not suffer from "translation ailment", as have the other sciences in the last 30 years. Pointing out that the need to work on computers in Hindi necessitates the development of relevent software, he called for developing a pictorial script for computers. Dr Baldev Vanshi of New Delhi felt that it was essential to touch the key problems regarding the script and stressed on the need to keep in mind the factors such as feasibility of implementation of

Hindi, purity of ideas along with the goad and the means, and the need to immediately standardize the recommendations of the various seminars. Dr Shiv Kumar of the Engineering College, Kota, gave detailed information about 'VIBHA', a computer language in Hindi developed by him and demonstrated its use in a computer programme in Hindi. Dr Narayan Dutt Paliwal, ex-Secretary, Hindi Academy, Delhi, stressed the need for coming together of computer scientists and linguists. Shri Jasvinder Singh of IIP spoke about 'Internet'. Dr Mahendrpal, also from IIP, showed, through an analogy with Japanese, Chinese, Russian & French, that the use of Hindi in computres can easily be made a reality. Dr P.B. Semwal of IIP suggested for the formation of a society of computer experts in Hindi. Dr Shiv Kumar expressed that we should ourself develop software in Hindi lest the multinationals start doing this as the prospects of a good market were very high. It was felt that there was no dearth of talent in India in this regard.

On the third day, Shri B.R. Nautiyal of IIP and Shri P.N. Chandola of CSTT dwelt upon their long experinece in coining of technical words. Shri Deepak Kumar, also of CSTT, proposed a programme on startified, class-wise teaching of computer science in schools and stressed the need for a wide-ranging debate on teaching of computer science in Hindi. Shri G.M. Bahuguna of IIP, talked of the various uses of computer science and said that in the Indian context, the use of Hindi in computers would not only prove their immense worthiness in the fields of population control, education, literacy, health, entertainment, etc. but would also prove how Hindi, in return, is useful in tackling these problems. He expressed the need for a change of language for achieving this and said that when we talk of computers, it is really not English versus Hindi, but in fact it is knowledge versus language. Presiding over the session, Prof. Suraj Bhan Singh stressed on the need of teaching of language through computers and developing software for grammar, pronunciation and text-comprehension for this purpose. Earlier, Prof. S.B. Singh minutely discussed the computer and its function and the efforts made in the direction of bringing Hindi into computer and its future prospects. Also covered seminar are: 'Computers : Principles and Elemental Analysis', 'Computers and the Official Language'.

Addressing the valedictory session as a special invitee, the ex- Foreign Minister of State, Government of India, who is a champion of Hindi, Shri Hari Kishore Singh, reiterated his commitment for Hindi. He criticized the dependence on a foreign language by stating that we cannot become rich by borrowing. Talking about the world scene, he said that even after the decline of the imperialist era in the post-World War II period, the same imperial forces were trying to extend their field of influence through indirect means like WTO, NATO, etc. and that only our native tongue would give us the necessary strength to fight them. He underlined the need to nurture and encourage the talent laying dormant in the country. Dr T.S.R. Prasada Rao, Director, IIP, expressed his happiness over organizing the seminar and said that it has proved that our scientists have the desire to do scientific writing in Hindi, but that it is yet to find expression and needs encouragement. He announced that IIP would publish all the papers of the seminar in book form. He also gave away certificates to the participants. Prof. P.S. Saklani, Chairman, CSTT, also expressed his views about the development of Hindi in its standard form. Conducting the proceedings, of the function, Dr D.C. Chamola expressed his happiness over the success of the seminar and reiterated that it would be through Hindi that science would touch the grassroot realities of India's millions. Proposing a vote of thanks, Shri S.P. Gera, COA, IIP, assured that he would make all efforts to help implement the recommendations of the seminar. ❑

Second Indo-Italian Round Table on Urban Planning and Socio-economic Development: Transport Infrastructure and Mobility within Indian Megacities

THE second Indo-Italian Round Table on Transport Infrastructure and Mobility within Indian Megacities was jointly organized by the Central Road Research Institute (CRRI), New Delhi and the Embassy of Italy at New Delhi on 22 April 1997. This meet was attended by more than 200 urban town planners, transport engineers and other experts from India and Italy. The aim of the meet was to discuss ways and means to solve transport infrastructure problems in the megacities of India, including Delhi and Mumbai

Prof. Y.K. Alagh, Minister of State for Science & Technology, inaugurating the Second Indo-Italian Round Table Conference on Urban Planning and Socio-economic Development: Transport Infrastructure and Mobility within Indian Megacities

and improve industrial development through transport.

Opening the meet, Prof. Y. K. Alagh, Union Minister of State for Science & Technology and Vice-President, CSIR, said that in India urban rail transport system which exists only in Mumbai, Calcutta and Chennai is less polluting and also less costly to users. But setting up this system required huge funds which is the major constraint with the government. He stressed the need for better co-operation between India and Italy in solving transport infrastructure and mobility problems in Indian megacities.

Prof. Abid Hussain, V.P., Rajiv Gandhi Foundation and a well-known expert, dwelt in detail on the economic aspects of urban infrastructure.

Prof. A. K. Gupta, Director, CRRI, said that management of urban transport in the country has not kept pace with the increase in population, per capita income, mobility rate and economic growth. It is necessary that an efficient transportation system be built which will increase the productive efficiency of the cities as well as solve the other civic problems.

Other dignitaries who attended the meet included Mr A. D. Narain, Director General, Road Development and Additional Secretary, Ministry of Surface Transport, Government of India; Professor Ganetano Galante, University of Naples, Italy; Prof. Aldo Di Lorenzo, Engine Institute, Italy; and Dr P. S. Rana, Executive Director, HUDCO, New Delhi ❑

TRAINING PROGRAMMES

Training-cum-Demonstration Programme for Rural Artisans on Blacksmithy

THE National Metallurgical Laboratory (NML), Jamshedpur, in association with CSIR Polytechnology Transfer Centre (PTC), Hyderabad and District Industries Centre (DIC), Ongole, organized a three-day training-cum-demonstration programme, during 3-5 March 1997, on blacksmithy for the rural artisans of Prakasham District at old DIC Office, Ongole. The programme was sponsored by SIDBI. More than 50 artisans participated.

The programme was inaugurated by Smt. Udaya Lakshmi, Project Director, DRDA, and presided over by Shri P.V. Narayana Rao, General Manager, DIC, Ongole. Shri R.G. Ganguly, Project Leader, Material Process Division, NML, delivered the keynote address.

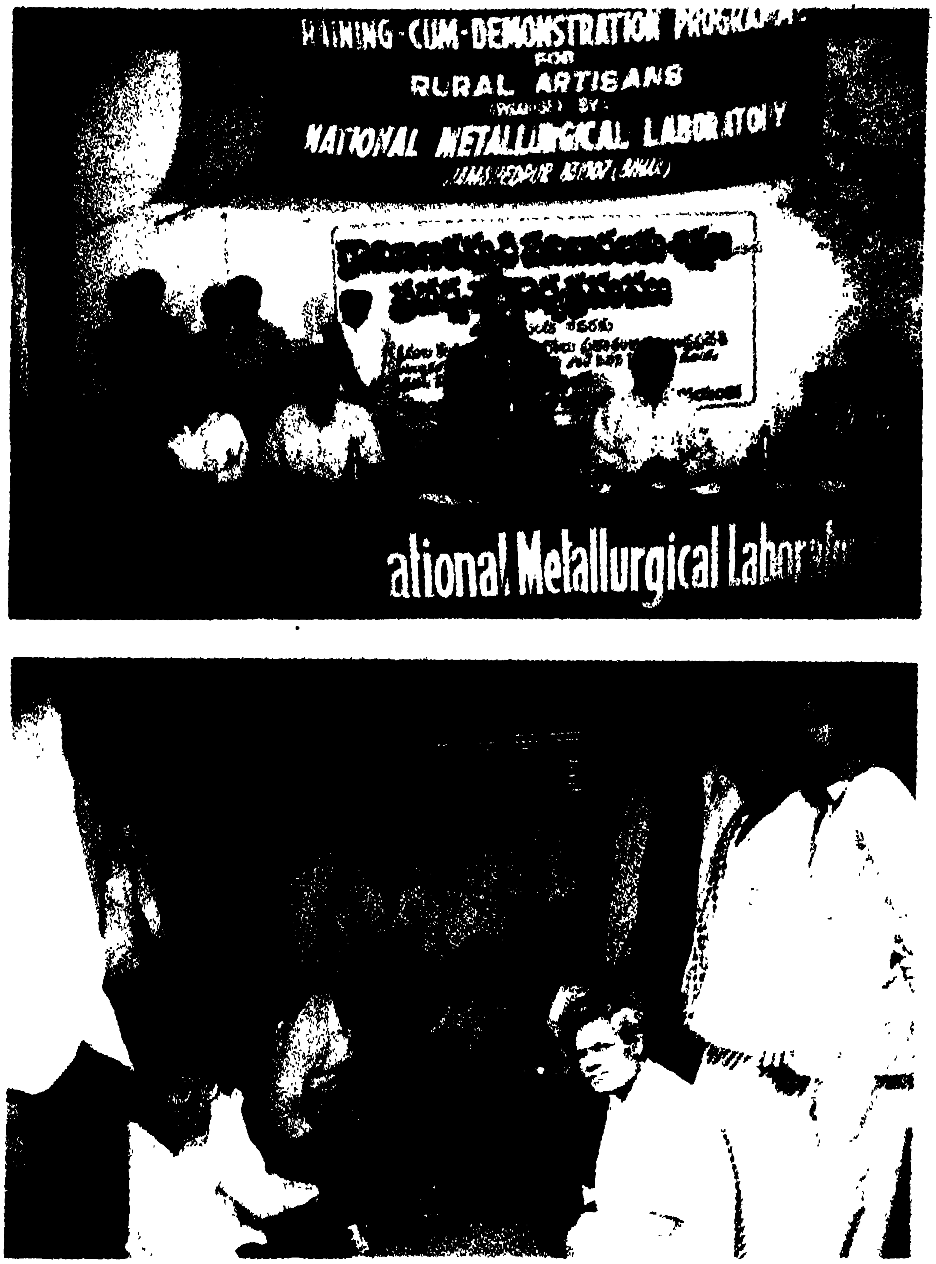
Shri N.C. Harshavardhan, Scientist, PTC, Hyderabad, explained about the activities of the PTCs and the various CSIR laboratories, for the development of rural industries in the state. He also proposed a vote of thanks.

In her address Smt Udaya Lakshmi, appreciated the efforts of PTC, Hyderabad, and assured all help to the artisans in getting loans.

Shri R.G. Ganguly, in his keynote address, highlighted the activities of NML in the development of an improved wear-resistant alloy cast iron, which can be directly cast to shape. The technique can be used for direct casting of plough share and other agricultural tools.

Delivering his presidential address Shri Narayana Rao expressed his happiness that the training programme was being held at Ongole and called upon the artisans to make maximum use of the programme. He assured the artisans all help in supply of the raw material, and also the necessary clearances for getting loans either from DRDA or banks.

The scientists of NML had a detailed discussion with the artisans on their present manufacturing methods, and explained in detail


RAINING-CUM-DEMONSTRATION PROGRA
FOR
RURAL ARTISANS
NATIONAL METALLURGICAL LABORATORY
ational Metallurgical Labora

Top: Smt. Udaya Lakshmi, Project Director, DRDA, Ongole, delivering the inaugural address. Seated on the dais (*from left*) are: Shri P.V. Narayana Rao, General Manager, DIC, Ongole; Shri R.G. Ganguly, Project Leader, NML, Jamshedpur; and Shri N.C. Harshavardhan, Scientist, PTC-Hyderabad. The second photograph shows practical demonstration of mould preparation for agricultural tools being given to the artisans.

about selection and standardizing of raw material for agricultural tools, mould preparation, fuel optimization for blacksmithy hearth, casting & heat treatment of agriucltural tools, etc.

The participants were shown how to modernize the existing furnaces for blacksmithy using bricks for prevention of heat loss, resulting in 50% reduction of coal consumption.

During the programme, the artisans were also taken to the Government Polytechnic and were given the demonstration and practical training on mould preparation for various agricultural tools.

The General Manager, DIC, distributed the tool kit bags to a few artisans whose performance during the programme was oustanding.

Shri Ganguly invited five artisans to NML for further training and requested GM-DIC to sponsor their names. The artisans expressed their satisfaction regarding the training programme and some of them desired to visit NML, for further training and later help their fellow-artisans in the Ongole District. ❑

ANNOUNCEMENTS

IIChE Golden Jubilee Congress and CHEMCON-97

ESTABLISHED at the dawn of Indian Independence in 1947, the Indian Institute of Chemical Engineers (IIChE) has, during its fifty years of existence, nurtured and advanced the professional culture by participating in national development programmes both at the university level and in institutes of Technology and Science. IIChE is organizing the Golden Jubilee Congress and CHEMCON-97 at the Indian Institute of Technology (IIT), New Delhi, from 15 to 18 December 1997. The Congress and CHEMCON-97 are designed to bring together eminent and world-renowned chemical engineers from various fields--education, research and industry — to demonstrate to the world community the contributions made by chemical engineers and their commitments towards not only sustainable developments but also with respect to enhancing the quality of life.

The programme will include Golden Jubilee and plenary lectures, keynote addresses and seminar presentations by invited speakers. Parallel technical and poster sessions of CHEMCON-97 will provide an opportunity to research scientists from universities, technological institutes and research laboratories to share their scientific findings and developments. A youth-oriented programme will also provide a suitable platform for the students of chemical engineering.

A comprehensive programme is also being formulated to bring into focus the interrelationship of chemical engineering with other important and related disciplines.

THEMES OF THE CONGRESS

A. Chemical Engineering and Sustainable Development

- Safety, Health and Environment
- Renewable Resource Engineering
- Energy Conservation

B. Future Process Technologies

- Food Processing and Agro Technologies
- Biotechnology
- Hydrocarbon Processing
- Petrochemicals and Polymers
- New Materials

C. Chemical Engineering Development

- Modelling, Simulation and Optimization
- Advanced Process Control
- Computational Fluid Dynamics
- Novel Separation Techniques

D. Chemical Engineering Science: New FrontierS

E. Process Industry in South Asia & Asia-pacific Region

F. Vision 2010 And BeyonD

Papers are invited on the identified themes and will be published as proceedings of the IIChE Golden Jubilee Congress. The full papers are to be submitted directly, i.e. there will be no intermediate stage of submission of abstracts. The papers will then be peer reviewed. Submission of the full papers is a requirement for presentation at the Congress. Detailed instructions for the preparation of manuscripts may be obtained from Dr Sunil Nath, Editor, IIChE Golden Jubilee Congress. Department of Biochemical Engineering and Biotechnology, Indian Institute of Technology, Hauz Khas, New Delhi 110016. E-mail: sunath@dbeb. iitd. ernet. in; Fax: 91-11-6862037/6868521; Tel: (Off) 666979/2017, (Res) 6857457.

Last date for receipt of full papers: 31 July 1997, and for registration 15 November 1997.

All correspondence regarding the above events may be addressed to: Dr M. D. Diwan, Organizing Secretary C/o Dharamsi Morarji Chemical Co. Ltd, 12, Ring Road, NDSE Part-1, New Delhi-110049. Tel: (Off) (011)4625170, 4692087; (Res) (011)6445414, 6460332; Tlx: 031-65648, Fax: 91-11-4625170; E-mail: ndelhi.dmcc@axcess.net.in;

or

Dr P. V. R. Iyer, Jt. Organizing Secretary, Dept. of Chemical Engineering, IIT Delhi, Hauz Khas, New Delhi-110016.

Tel: (Off) (011)666979/2033; (Res) (011)6515315; Fax: 91-11-6862037, 91-11-6855227 ❑

Message from Dr R. A. Mashelkar, Director General, CSIR and Chairman, Organizing Committee, IIChE Golden Jubilee Congress and CHEMCON'97

The Golden Jubilee celebrations of IIChE is an occasion which rings a responsive chord to pause, reflect and contemplate on the past achievements and also to closely examine our inadequacies. This is thus a time to readjust and reorient our future developments and actions in all these components viz., education, R&D, manufacturing, agriculture, management, etc. in the context of changing trajectories of world economic, scientific and technical services.

Our response to these rapid changes has to be a continuous upgradation of our total national efforts as a medium of opportunity and transformation

To celebrate this occasion and for the future to be secure, we need 'The Pull of Ideas' which are implementable and which symbolise our creative urge for a glorious future.

The Chemical Engineering Community has a great responsibility in shaping the future course of our national developments.

This is also an occasion when we respectfully would be paying our homage to all those pioneers, who by their convictions made this possible. This thus is a Day for a 'Roll Call for rededication and jubilation' ❑

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit
Annual Subscription : Rs. 60
Editor : Dr B.C. Kashyap Editorial Assistant : Neelima Handoo Production : Kaushal Kishore Single Copy : Rs. 3.00
Phone : 5786301 Gram : PUBLIFORM Telex : 031-77271 E-mail: niscom@sirnetd.ernet.in. Fax : 5787062

ISSN 0409-7467

VOL 47 NO 13 15 JULY 1997

CSIR NEWS

IIP signs agreement with Stone & Webster Engineering Corporation for marketing of its technologies abroad

THE Indian Institute of Petroleum (IIP), Dehra Dun, has entered into an agreement with the Stone & Webster Engineering Corporation (SWEC), USA, on 6 June 1997, for marketing of its technologies abroad. One of these is the visbreaking process for upgrading the atmospheric and vacuum residues by thermal conversion to manufacture light and middle distillates as well as reduce the viscosity and pour point of residues for their utilization as fuel oil.

In India, six visbreaking units are in operation and one at Panipat is in the advanced stage of commercialization. The total capacity of these plants is 6.1 million TPA. The older units were based on coil visbreaking and all these units are being revamped for soker visbreaking which has inherent process and product advantages. Five of these plants have been/are being revamped by the Engineers India Ltd, based on the data developed at IIP's visbreaking pilot plant. The units which have already been revamped are at IOC Gujarat, IOC Mathura and Cochin Refineries. The two units which are being revamped are at IOC Haldia and Madras Refineries Ltd, Chennai. The total capacity of these units is 5.25 million TPA. Thus almost all the older units in India have been /are being modernized using IIP-EIL technology. A grassroot unit at IOC Panipat of 0.45 million TPA capacity, based on IIP- EIL technology, is fast nearing completion.

IIP has been in touch with SWEC regarding marketing of some of its technologies abroad. SWEC is one of the world's leading engineering, construction and consulting company covering a wide range of fields including petroleum refining, petrochemical and chemical plants, oil and gas production, both on-shore and off- shore, and oil, gas, coal and lignite power plants. The company provides full range of project services from feasibility, financial and siting studies through design and engineering procurement, construction, commissioning and start-up of plants support and project management. The company has its presence over 60 countries and is engaged in over 2000 projects. It has so far executed 29 projects in India, the latest being the one for Reliance Industries. IIP and SWEC are now jointly offering a revamping job for a refinery in Latin America. A salient feature of the IIP-SWEC agreement is that apart from joint sharing of the licensing fee/royalty from technology transfers, a certain percentage of this money has been fixed for joint developmental work for further improvement in the technology. This is perhaps for the first time that such an agreement has been made with a foreign company by a CSIR lab.

Press Conference

In a press conference held at the CSIR Vigyan Kendra in New Delhi, on 7 June 1997, IIP Director Dr T.S.R. Prasada Rao told the media persons that almost every refinery in India has technologies licensed from IIP. But for marketing of technologies at the global level it is essential to have a world-wide network and a strong engineering back up. IIP was trying to achieve this by forging alliances with international R & D organizations and companies. The joining hands with Stone & Webster Engineering Corporation was a step in this direction, he added.

Mr Warren Letzsch, Sr. Vice President of SWEC, who had come to India to sign the agreement, and Mr R.E. Romer, SWEC's Country Manager for India, spoke about the activities and accomplishments of their company.

The speakers also briefed the media persons about salient features of the agreement. ❑

International Conference of Safety in Mines Research Institutes

EXPLORATION, innovation and adoption of safe, modern technology in mining for the benefit of mankind in general and mine workers in particular were the main issues discussed at the twenty-seventh 'International Conference of Safety in Mines Research Institutes' (ICS-MRI'97) held in the recent past in New Delhi. The conference, held for the first time in this part of the world, was organized by the Central Mining Research Institute (CMRI), Dhanbad.

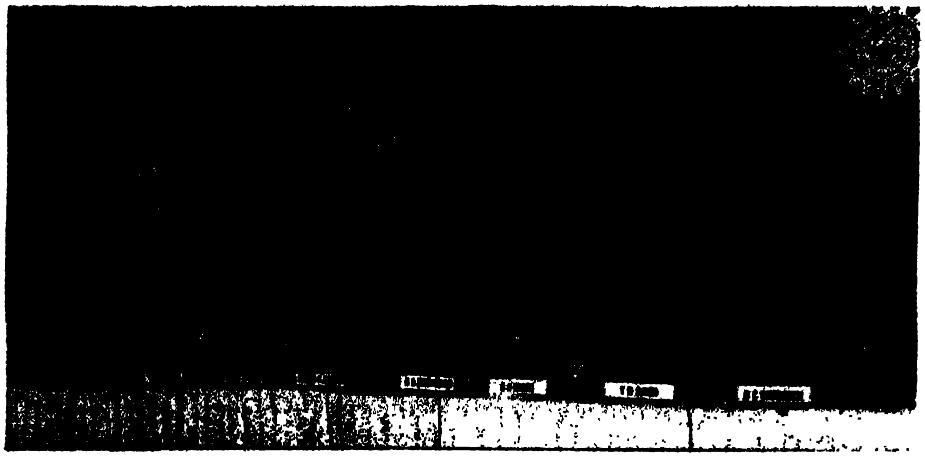
Over 230 delegates, including 77 participants from Australia, China, Czech Republic, France, Germany, Japan, New Zealand, Papua New Guinea, Poland, Romania, Russia, Spain, South Africa, UK, Ukraine and USA attended the conference.

It was co-sponsored by Directorate General of Mines Safety (DGMS) and Coal India Limited (CIL), and supported by the National Mineral Development Corporation (NMDC), Bharat Coking Coal Limited (BCCL), South Eastern Coalfields Limited (SECL), Central Coalfields Limited (CCL), Central Mine Planning & Design Institute Limited (CMPDIL), Northern Coalfields Limited (NCL) and Indian School of Mines (ISM). The deliberations were held in 18 technical and one poster sessions, in addition to the inaugural and valedictory sessions.

Inaugural Session

The Chief Guest was Mr Purno A. Sangma, Speaker, Lok Sabha, who in his address said, "The struggle of the human kind for the survival and development has always been a challenge to the nature and violence to the environment. Whether it is exploring the bowels of the earth or the depths of the oceans, human beings have been prodigal children squandering the bounties of nature and endangering future survival of their own kind". Elaborating his point the Hon'ble Speaker added, "Vast expanses of the earth's scarred surfaces, which look like moonscape, are common sights in mining areas. Gigantic profusion of oil spills during offshore drilling for fossil fuel destroying invaluable marine life is reported every now and then. Air and water do come under incredible levels of pollution causing serious health hazards to people and adversely impacting on floral wealth and agricultural activities." He also pointed out various types of accidents and diseases associated with mining, and pointed out, "Mining without protection of environment cannot be sustainable, and to make the mining environment eco-friendly, significant investment of human and material resources should be diverted to R&D.

Dr R.A. Mashelkar, Director General, CSIR, presided over the function. He in his speech said, "Despite the fact that mining is one of the most safety conscious industries of the world, disaster potentials



Mr P.A. Sangma, Speaker of Lok Sabha, delivering his inaugural address at the 27th International Conference of Safety in Mines Research Institutes. Sitting on the dais (from left) are: Mr John N. Murphy, Mr V. Mahajan, Prof. B.B. Dhar, Dr R.A. Mashelkar, Mr B.C. Mishra, Dr T.N. Singh and Mr B.C. Bhowmick still remain quite high." Referring to the fatality rate per million tonnes of coal produced, he pointed out, "It is high in India compared to that in developed countries and we are making all efforts to see that there is a definite decline in this figure."

According to him, the occurrence of two disasters in our coal mines in the recent past is a sad reminder of the fact that there is much scope for intensifying our R&D efforts in the fields of mine fire and inundation. In this context, while appreciating CMRI for its contributions to research in mining, he pointed out, "CMRI has recently proposed an innovative cryogenic technology for quick dewatering of inundated mines." In the same breath he added, "Another field of vital importance to ensure safety in mines is to provide safety chamber in the underground for rescuing miners during any calamity due to explosion and inundation. CMRI has taken up a project on this concept with all seriousness." To accelerate the growth of R&D in mine safety he also floated the idea of World Mining Research Centre.

Director General of Mines Safety Mr V. Mahajan opined, "The problem of mine safety in India is unique. The place-wise accident analysis has revealed that about 66% of accidents occur in underground workings, 18% in opencast mining and 16% in surface operations. The cause-wise analysis shows that human failure is the major factor responsible for accidents."

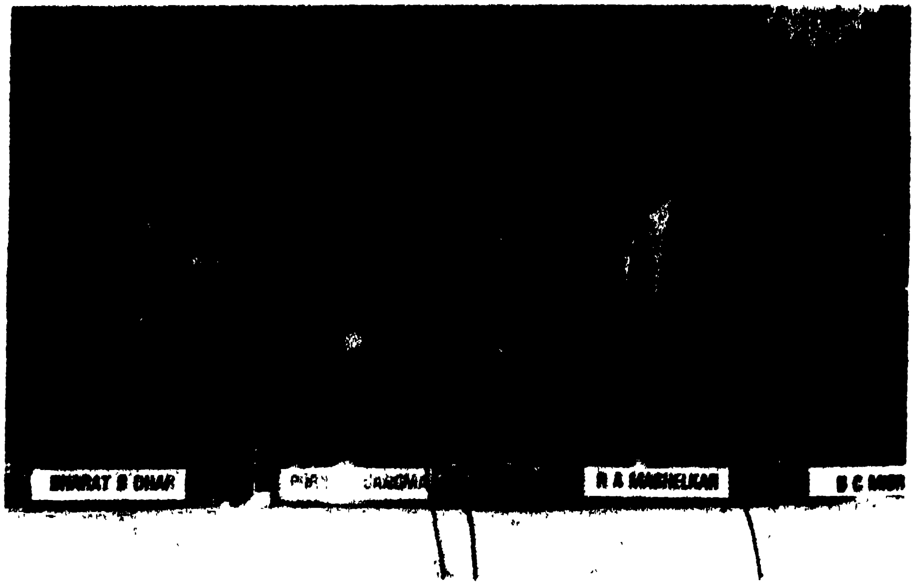
According to him, technical problems have just made a beginning to cause accidents. The problems which are now being encountered by other countries are going to be faced by us as our mining operations are gradually extending to deeper horizons and more difficult geo-mining conditions. Increased mechanization is also likely to breed new problems.

He also advocated for judicial blend between fundamental and applied research (both short-term and long-term) to ensure practical solutions of the existing problems and generation of data with an eye to rein in future difficulties.

"Legislative measures are the gist of collective wisdom, experience and global practices developed over a long period. Further, progress should be an ongoing process and it needs to be reviewed with the development of research and mining practices." Mr Mahajan remarked.

Mrs Leyla Tegmo Reddy, a representative of International Labour Organisation (ILO) pointed out, "Safety is associated with efficiency because in a safe, accident-free working environment there are no work interruptions, no delays, and the morale of the work-force is higher than in unsafe situations. The result tends to be higher productivity." "There are also sound economic reasons for ensuring a safe and healthy work place. In addition to the human and social costs of occupational injuries and diseases, there are economic costs borne by those affected, and by enterprises, industries and governments. Direct costs of accidents and diseases for enterprises include material damage, down time, insurance premiums and medical expenses plus less tangible factors such as loss of company prestige and deteriorating industrial relations. The cost of the loss of production, property and corporate image arising from serious accidents can be up to 50 times their direct costs."

Earlier, delivering his welcome address, Prof. Bharat B. Dhar, Chairman, Organizing Committee. ICS-MRI'97 and Director. CMRI, touched upon the history of ICS-MRI. He said, "The first International Conference of Safety in Mines Research Institutes was held in Buxton, UK, in 1931. It has its string from an International Conference of Mine Experiment Stations organized in Pittsburgh, USA, in 1912, from which the idea of ICS-MRI sprouted. The conference with its glorious



Shri P.A. Sangma releasing the conference volume past, has today become a recognized and accepted forum of senior mining engineers, mine operators, research scientists, academicians, government agencies, labour organizations and others who are associated with the mining industry all over the world to discuss and evaluate the problems and achievements of safety in mines. Generally, it takes place once in every two years in different corners of the world on any well thoughtout theme." Referring to the present conference, he said, "The theme of today's conference is Current Status of Mine Safety Research" and it would address the problems of coal mines, metal mines, general safety aspects and environmental protection to make mining safer.

Mr John N. Murphy, Director Research, Pittsburgh Research Centre of National Institute of Occupational Health & Safety, Pittsburgh, USA. In his brief speech, outlined the rich heritage and long history of the conference and pointed out that events with high disaster potentials have traditionally been the major focus of discussion in this conference. He also complimented CMRI for the special efforts made to make the conference a grand success.

Representing the Indian coal industry, Mr B. C. Mishra, Chairman-cum-Managing Director, Central Mine Planning & Design Institute Limited (CMPDIL), Ranchi, highlighted *inter alia* the activities of his institute, capabilities of Indian coal mining sector and hoped that interactions with experts and professionals from all over the globe would facilitate adoption of state-of-the-art safe technology in Indian mines.

Dr T.N. Singh, Seniormost Scientist, CMRI, summed up the inaugural function and proposed a vote of thanks to all the dignitaries attending the conference.

Technical Sessions

The first session, which was a Plenary Session, had four papers: Global trends in development of mini safety technology — A need for international collaboration (B.B. Dhar, India), United States mining health and safety research (John N. Murphy, USA), Legal system for safety in the Polish mining (M. Filipek, Poland), and Indian mine safety — Problems and challenges (T.K. Majumdar, B. Bhattacharjee and V. Mahajan, India).

This was followed by the presentation of around 100 papers in 18 sessions on: Safety Management; Safety Technology; Mine Ventilation; Methane Monitoring; Ground Control I & II; Hazard Mitigation, Mine Fire I & II; Mines Safety Appliances; Monitoring, Modelling & Networking; Work Environment; Technology Development — New Initiatives I & II; Blasting & Explosives; Eco-friendly and Safe Mining; and some miscellaneous aspects. Nine papers were presented in the poster session. In addition, 22 papers were received and are included in the conference volume, but could not be presented. The two-volume conference volume (having a total of 134 papers) has been edited by Prof. B.B. Dhar and Mr B.C. Bhowmick of CMRI, and has been printed by Oxford & IBH Limited, New Delhi. A sleek souvenir was also brought out giving history of the conference and two articles describing life sketch and achievements of two pioneering researchers in mine safety.

Exhibition

Added attraction of the conference was an 'Exhibition of Mine Safety Items,' which was inaugurated by Mr P.A. Sangama on 20 February 1997. Along with CMRI, other organizations like DGMS, CMPDIL, Usha Martin, PVR Inshield Bituminous Private Limited, IBP and Veecon-Ipa Gastechnik Limited took part in the exhibition. The stalls were full of artistically arranged innovative exhibits which attracted a large number of distinguished visitors from India and abroad.

Meeting of the Heads of Delegations

During the conference an important event was the meeting of the Heads of delegations from different countries to discuss the strategies of ICS-MRI and other issues. The members, after detailed deliberations, un-animously agreed on the following points: INSEMEX, Romania will host the next conference in 1999; The name of the conference will remain unaltered; Loose federal structure of the organization which has served the conference well so far will continue; Interchange of research findings will be encouraged to avoid the repetition of the research work; and Funding of joint research projects will be encouraged between the various parties of interest. Country coordinators may act as nodal agents for such purpose.

Valedictory Function

The valedictory function had the Union Minister for Labour Shri M. Arunachalam as the Chief Guest. In his address he asserted, "The new liberalized industrial policy pursued by the Government of India would lead to accelerated growth in mineral industry to complement and supplement the revival and rapid growth of national economy. Our government has opened up the coal mining sector to private investment and we hope for an accelerated development in this vital area. The present day environment demands to have a fresh look at safety management as a structured process composed of well-defined systems that emphasize continuous improvement in work quality, health, welfare and productivity of work-force engaged in mineral industry through setting up of improved safety standards and their effective implementation and administration."

Dr Lakshmidhar Mishra, Secretary, Ministry of Labour, Government of India, who presided over the function, suggested that the findings of scientific and technical research related to safety should be disseminated properly instead of confining these to the four walls of a research laboratory. He also wished that workers should be more safety minded.

According to Prof. Bharat B. Dhar, the economic development of any country is directly related to mining of minerals and fossil fuels and their subsequent use, which forms the backbone for industrial development. However, in the process of achieving production targets to meet the growing demands, safety becomes a casualty. Scientists are ever conscious of the safety aspects and are, therefore, always trying to devise and invent techniques and technologies to keep the mining operations safe, economic and production oriented. He also stressed for greater co-operation between the Ministry of Coal, Ministry of Mines, public and private sector undertakings, CMRI and DGMS, for better results.

Mr V. Mahajan, Director General of Mines Safety, said, "International collaboration, liaison and information exchange between law enforcement authorities are extremely important aspects for the standardization of research findings, review of existing enforcement strategies and formulation of future strategies and proposed. "Similar to this ICS-MRI, a conference of Chief Inspectors of Mines should be held once in two years stagged with the timings of ICS-MRI."

Mr Ioan-Nicolae Caprar of National Institute for Safety in Mines and Exploration Protection (INSEMEX), Petrosani, Romania, complimented CMRI for the hard work done in making the conference a grand success. He was happy that the head of delegates of different countries attending the conference had unanimously approved the request of his institute to organize the next conference (28th ICS-MRI) in Romania in 1999 which coincides with the Golden Jubilee Celebration of INSEMEX. He extended cordial invitation to all present to Romania.

Mr B. C. Bhowmick, Scientist, CMRI and Convener of the Conference, proposed a vote of thanks.

OBSERVATIONS/ RECOMMENDATIONS

Mission Statement: The purpose of the International Conference of "Safety in Mines Research Institutes" is to provide a forum for individuals and organizations to share progress and discuss problems of mines safety and health.

General

- The conference continues to serve its mission well.
- The frequency of every two years is appropriate.
- The concept of a rotating host country is good and should be continued. The use of country coordinators has served the conference well and should be continued.
- The conference is not the only mechanism for communications. Detailed collaborations between institutes or investigators should be promoted and facilitated by the country coordinators.
- It is recognized that such collaboration requires careful planning and detailed discussions which must take place among interested parties.
- If interested organizations do not know the potential collaborators in other countries, the country coordinators will serve as a point of contact to identify potential collaborators.
- It is recognized that technology transfer is appropriate activity prior to initiating a new research project. It requires strong leadership in the respective institutes to eliminate the "Not Invented Here Syndrome."
- It is recognized that for a joint project to be successful, all of the participating organizations anticipate the value received from the collaboration be equal to their investment.

Specific to Indian Conditions

- The trend of reduced funds for safety and monitoring is a matter of concern. Without adequate financial resources continued progress in mine safety will not be possible.

- A stable source of funds is necessary. One approach to provide appropriate funding for the mining industry and government is to earmark 0.5% of industry profits and 0.5% of royalties and taxes for mine safety research in addition to the current funding.

- Priority technology transfer and research area for Indian mines are:

a) Prevention and control of coal mine fire

b) Prevention of methane explosions

c) Prevention of inundations by identifying waterlogged mine workings in areas where survey maps are not reliable or available.

d) Development of designs of barriers to reliably separate waterlogged mine workings from active workings and means to accelerate the replacement of timber in mines with modern supports such as rock bolts and cable bolts.

e) Development of systems for reliable communication, monitoring, navigation and evacuation alarms.

f) Development of better means for assisting evacuation from smoke filled roadways.

g) Development of permitted blasting materials and procedures and other methods for underground coal mines that can be used as an aid to hard roof rock management

h) Development and adoption of systems safety methodology to evaluate and reduce accidents. Role of human behavioural aspects may also be studied.

i) Refinement of environmental safety and health standards as well as surveillance procedures to reflect the state-of-the-art in safety and health technology.

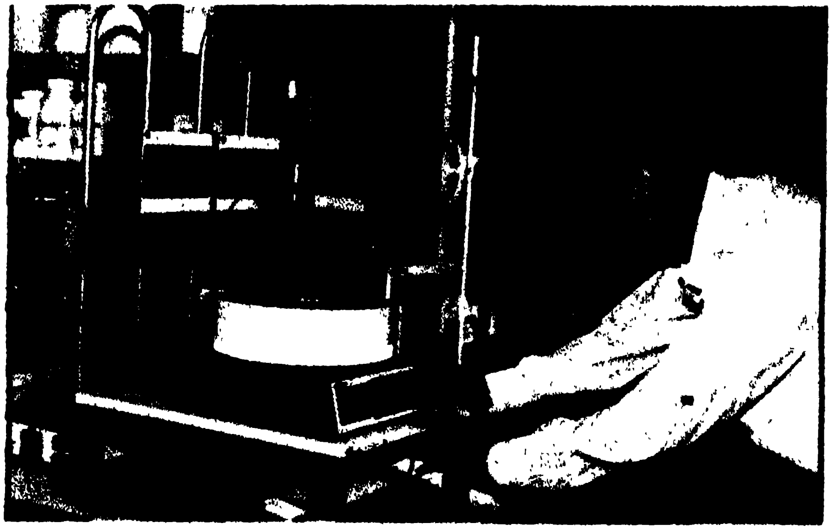
j) Development of means to monitor and reduce health exposure from respirable dust, diesel emission and noise

- Before introduction of foreign mining technology and methods in Indian mines, their impact on health and safety and other issues should be thoroughly assessed by the R&D institutes and regulatory bodies. ❑

INSTITUTE OF MICROBIAL TECHNOLOGY, CHANDIGARH
R & D Highlights 1995-96

PURSUING its R & D programmes in areas of Molecular Biology, Microbial Genetics & Microbiology; Animal Cell/Tissue Culture; Fermentation Technology; and Protein Engineering, the Institute of Microbial Technology (IMTECH), Chandigarh, during 1995-96 made steady progress in both industrial and scientific activities.

With a view to developing a microbial process for the production of N-carbamoyl-D-*p*-hydroxyphenylglycine from DL-hydroxyphenyl hydantoin, methods for chemical synthesis of the precursor molecules hydroxyphenyl hydantoin (HPH), and phenyl hydantoin (PH) were standardized. N-carbamoyl derivatives were also synthesized and assay methods for quantification of the final product established. Screening of various soil samples was done and four organisms expressing this activity with HPH as the substrate were chosen for further studies. The organism, although a mesophile, elucidated a thermostable hydantoinase. Stereoselectivity of the enzyme was then ascertained by chiral TLC followed by polarimetry. The enzyme was found to be strictly D-specific. The temperature and *p*H optima of the D-hydantoinase have



Protein Purification System at IMTECH

been found to be 65°C and 9.0 respectively. Preliminary media optimization studies have been initiated.

The construction of stable haploids from a homothallic diploid yeast strain used in distilleries was carried out earlier. This was done for ease of isolation of recessive mutants that do not show up in a diploid background. Now two thermotolerant strains have been obtained from these haploids by mutagenesis and selection. These mutants produce as much or more ethanol than the parent diploid strain in trials done in a rich medium at 38°C; they also survive 12-16 h longer than the parent strain in fermentation broths containing >10% v/v ethanol at 38°C. When both, inoculum preparation and fermentation, were done at 38°C and with similar starting sugar concentrations, the differences in performance became more pronounced, while the mutants produced >10% v/v ethanol, the parent strain produced <5% v/v ethanol. Similar results were obtained in molasses fermentation as well; while the mutants produced >8.5% v/v ethanol, the parent strain produced <2% at 38°C in 32 hours. The mutations were found to be recessive in genetic crosses, and thus could not have been directly isolated from the parent diploid strain. The mutations complement each other, and thus appear to be in different genes. However, this is yet to be confirmed, since some mutations may express only in a haploid genetic background.

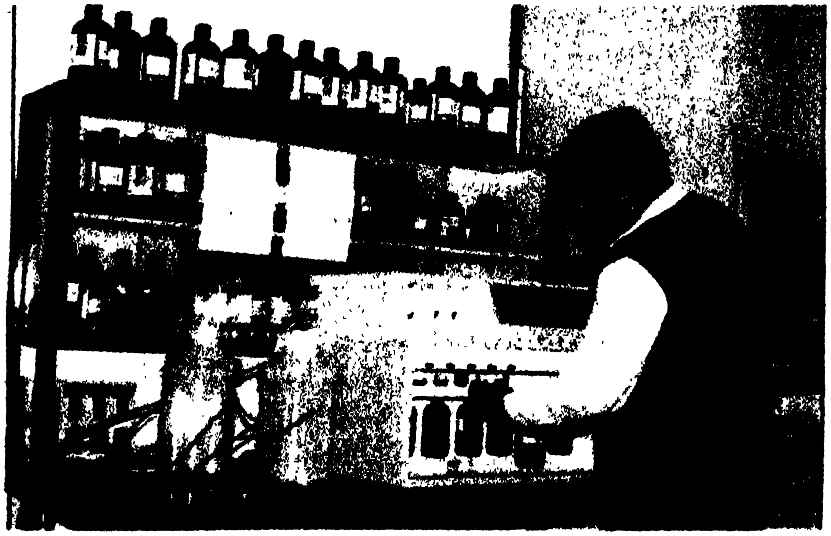
Streptokinase (SK), a protein secreted by several species of the genus *Streptococcus*, has traditionally been used for the treatment of several circulatory disorders, including myocardial infarction (heart attacks). SK is secreted in relatively low yields from its natural host, and is also accompanied by the excretion of several toxins. Studies were carried out for the development of technology for large scale production from an alternative source (*E. coli*) of a recombinant form of this clot-dissolver drug in pure, pharmaceutically acceptable form using rDNA techniques. A process for the downstream processing of the native like component of recombinant SK (rSK) has been evolved that yields highly pure, pyrogen-free SK at an average yield of 75-80%. Quantities necessary for the structural and toxicological evaluation of rSK (500-1000 mg) have been purified. The purified rSK displays a specific activity that is comparable to that reported for the wild type SK. In addition, preliminary results from the animal toxicity studies indicate that even at very high test doses, the protein does not display any adverse effects.

Substantial progress was made in understanding the molecular details of interactions between streptokinase and plasmin.

A monoclonal antibody was isolated which strongly reacted with all the strains of *Leishmania donovani*. Also, a recombinant yeast strain was developed which could prove useful in function-based screening of androgens.

A prototype vaccine strain VA1.3 of *V.cholerae* was constructed (working in collaboration with Dr G.B. Nair of NICED, Calcutta and Dr R.K. Ghosh of IICB, Calcutta) from a naturally occurring non-toxinogenic, non-reactogenic strain of *V.cholerae* 01, designated VA1, in which the gene for the B subunit of the cholera toxin placed under its own promoter, SD sequence and terminator, was cloned into the *hly* site. This construct was tested at NICED and was found to give complete protection against the challenge doses of both *V. cholerae* 01, classical and EL Tor. Further analysis of the strain showed that it contains attRS1 sequence. Efforts are now underway to get rid of this element from VA1.3. A rec-version of the vaccine strain which is also devoid of vector sequence has been created. Efforts are underway to test the strain by RITARD.

In collaboration with Dr R.K. Ghosh and his group at IICB it has



Studies being carried out using the DNA synthesizer at IMTECH been shown for the first time that some strains of *V. cholerae* 0139 are host to a filamentous phage named SVK which contains single-stranded DNA that can integrate into the genome of the host. This is an extremely novel finding whose full implication is under active study.

The other major projects being pursued at the institute include: Microbial Degradation of poly-cyclic aromatic hydrocarbons (PAHs); Construction of genetically-manipulated strains; Metabolism of gaseous alkanes in bacteria: Genetic study of the pathways; Microbial production of biosurfactants: Isolation and characterization of biosurfactants, and identification of strains; Study of changes of Leukemic lymphocyte cytoskeleton and its role in altered cell motility; Development of an *in vitro* model system for screening of endocrine disorders due to mutation in steroid receptor gene and possibility of its repair by gene targetting; Molecular genetic studies towards the construction of novel fission yeast *(Schizosaccharomyces pombe)* strains for use in improved screening assays of biologically active substances; Chemical synthesis, conformational analysis and biological studies of an epitope of mycobacterial antigen responsible for autoimmune adjuvant arthrites; Role of DNA replication and repair in gene regulation during mating type switching in fission yeast; Antibody-mediated selected delivery of drugs to pathogen infected macrophages; Study on mechanism of mycobacterial pathogenesis in macrophages; Membrane structure function and possible applications in site-specific drug/antigen delivery; Molecular and bioprocess strategies for improving plasmid stabilities in genetically modified microorganisms; Biologically stabilization of industrial effluents with a special emphasis on textile and dye stuff manufacturing waste; A lignin biodegradation process for treatment of paper and pulp industry effluents; An analysis of protein structure to elicit the principles for knowledge based protein modelling; and cloning and expression of the bovine growth hormone gene.

National Facilities

The institute houses three national facilities: Microbial Type Culture Collection & Gene Bank (MTCC), Biochemical Engineering Research and Process Development Centre (BERPDC) and Bioinformatics Centre (BC).

MTCC during the year registered more than 25% increase in demand for its cultures as compared to the previous year. A total of 934 cultures were supplied to the users. Sectionwise break-up of the cultures supplied is — Actinomycetes-79, Bacteria - 484, Fungi-223, Plasmids-44 and Yeasts-104.

Number of isolates identified on requests from users has also gone up during 1995-96; a total of 135 unknown microorganisms were identified by MTCC. Electron microscope facility was extensively used by in-house scientists and by other investigators from Delhi, Pune, Karnal as well as from Panjab University and PGIMER, Chandigarh. Number of cultures in the collection has also been rising steadily. It is proposed to generate MTCC catalogue of strains on disk.

The BERPDC facilities were utilized by International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi, Indian Institute of Chemical Biology (IICB) and the researchers from the Biochemistry Department, Punjab Agricultural University, Ludhiana. As an ongoing activity, BERPDC helps users from non-profit organizations such as R&D laboratories and universities by extending them the use of laboratory fermenters, analytical and other downstream processing equipment.

The Centre also carried out inter-departmental research work, e.g. optimization of production conditions for amylase, alcohol, streptokinase and biosurfactants in collaboration with other Divisions of IMTECH. Two students from Guru Nanak Dev University, Amritsar and one student from Panjab University, Chandigarh, received training in microbial biochemistry, basic fermentation and biochemical engineering for a period of two months.

The Bioinformatics Centre has been set up under the Bioinformatics programme of the Department of Biotechnology to develop the computer software, database and other tools required for protein modelling and protein engineering and to provide the general facilities to the user. During the year, the Centre created a Protein Secondary Structure Database (PSSD) for the proteins whose resolution is 3.2 Å or higher. Also, it created/modified several software packages. The source code of Unix Copy Program (UUCP) was modified to implement the package on DEC/alpha workstation under the Open VMS environment. Software package HPat and CAng have been developed for creating the databases. HPat allows the creation of the hydrogen bond pattern between backbone-to-backbone, backbone-to-sidechain and sidechain-to-sidechain from Protein Databank. CAng computes the Cα- Cα-Cα angles between alpha carbon atoms from the PDB files.

The Centre organized a national workshop on 'Computer-Aided Protein Design' in November 1995, which was attended by more than 20 participants from various institutions. The Centre also provided training facilities to students from Kurukshetra and Panjab universities.

IMTECH also organized a National Symposium on 'Pasteur's Heritage' and a Brain Storming Session of 'Molecular Immunology Forum', and collaborated with the Centre of Biotechnology, Panjab University, in organizing the fourth 'Chandigarh Symposium on New Biology'.

The institute continued to maintain close linkage with universities, R&D institutions and industries for both the development of interactive programmes as well as for manpower training. It is recognized as a centre of research leading to Ph.D. degree by several universities, and is also collaborating with the Punjab University in running a two-year M.Sc. course in Biotechnology. Summer training to M.Sc. (Biotechnology) students of various universities is provided on request. ❑

Seasonal Dynamics of Methane Efflux from Wetlands

S.N. Singh, Kamla Kulshreshtha & Shubhra Agnihotri

Environmental Botany Laboratory
National Botanical Research Institute, Lucknow

METHANE is one of the important long-lived (residence time 10 yrs) greenhouse gases present in the atmosphere, in addition to CO_2, N_2O, O_3, water vapours and chlorofluoro carbons (CFCs). These all are radiatively active gases and fairly transparent to incoming shortwave solar radiations, but absorb and reflect longwave radiations emitted from the earth surface. In this process, a part of energy of longwave radiations is trapped within the atmosphere, which raises the earth's surface temperature, disturbing the normal heat radiation balance of the planet.

Mixing ratio of methane in the atmosphere is at present 1.72 ppmv. Recent studies of ancient air trapped in polar ice cores have revealed that atmospheric concentration of CH_4 has become more than double from the pre-industrial level of 0.7 ppmv in over 200 years. Since the last two decades, its level is increasing at the rate of 1-2% per year in the atmosphere, causing serious global concern in view of its significant (20%) contribution to global warming.

In spite of its low concentration as compared to CO_2 in the atmosphere, CH_4 is thought to be a major threat to climate change after CO_2, because it absorbs 25 times more heat than CO_2 on molecule to molecule basis. According to a study, doubling of CH_4 concentration from the pre-industrial level could alone lead to an increase in the average tropospheric temperature by 0.2 to 0.3°C. Besides, CH_4 influences tropospheric and stratospheric O_3 concentration and is also a major source of stratospheric water vapour.

Methane is primarily of biogenic origin and is produced strictly in the oxygen-deficient environment of natural wetlands and rice-fields by the action of methanogenic bacteria, as a terminal product of organic carbon remineralization in the sediments. Among other major sources of methane emission are enteric fermentation, biomass burning, termites and oceans. However, wetlands and rice-fields alone contribute nearly 40% of total global methane emissions.

The main pathways of methane production are the reduction of CO_2 with hydrogen, fatty acids or alcohols and the transmethylation of acetic acid or methyl alcohol by bacteria in the absence of dissolved O_2 and alternative inorganic electron acceptors, such as sulphate. CH_4 so produced in the sediments is transported to the atmosphere by (i) emission from air-water interface, (ii) gas bubble ebullition, (iii) plant-mediated gas transport through aerenchyma or intercellular spaces, in increasing order of importance. In the process of transportation from rhizosphere to troposphere, a major portion of CH_4 is oxidized by methanotrophs seated in the oxic environments of the wetlands. However, atmospheric CH_4 is decomposed by electronically excited radicals, O(^{1}D)H, and UV radiations gradually. In the stratosphere, while on one hand it prevents depletion of ozone layer, which saves us from onslaught of harmful UV radiations by readily combining with Cl atoms released from CFCs, on the other, it forms water vapour in chemical degradation with OH, which serves as seats for photochemical reactions leading to destruction of stratospheric ozone. Thus methane behaves both as a friend and a foe in the stratosphere.

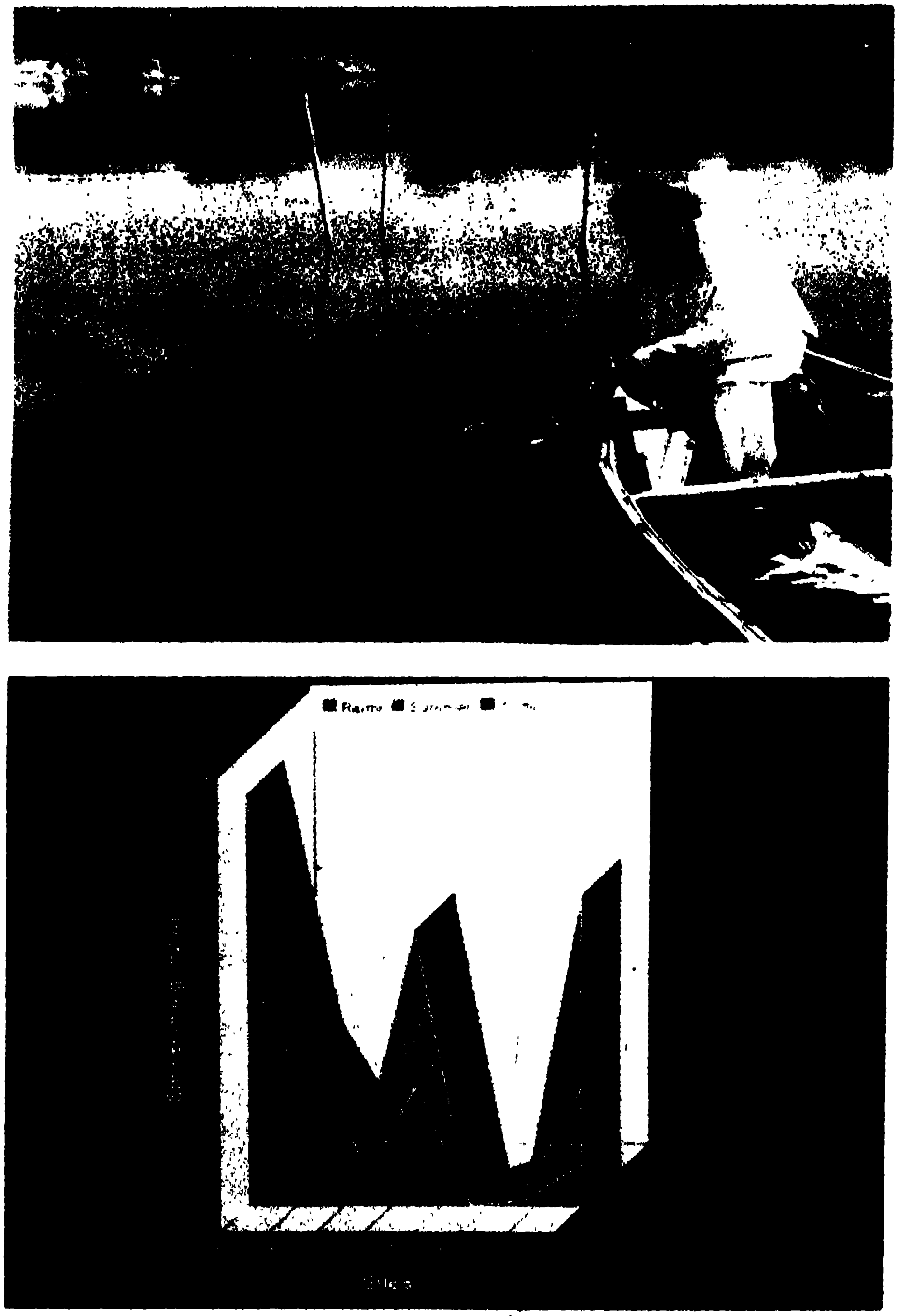
Although CH_4 is mainly transported through aquatic plants to the atmosphere, they do not directly participate in methane formation, but they do influence methane emission in various ways: (1) by providing substrates in the form of root exudates or root autolysis products and (ii) by generating oxic environment in the sediments through O_2 transport to rhizosphere which stimulates CH_4 oxidation or inhibits methanogenesis.

R&D at NBRI

In view of major contribution of CH_4 to global warming and India being surmised to be a great contributor to global methane budget, a study 'Methane Campaign 1991' was undertaken earlier at All India level involving 16 centres including National Botanical Research Institute (NBRI), Lucknow, to measure methane efflux from rice-fields in different agro-climatic regions of the country. This study categorically proved that Indian rice-fields are emitting only 4.0 Tg/annum methane, one-tenth of the value projected by Environmental Protection Agency, USA.

As wetlands form the dominant source of CH_4 emission, NBRI is working now on a DST-sponsored project on 'Investigations on methane efflux from water bodies', with a view to determining the source strength of local water bodies and elucidating the pathway of CH_4 transport through aquatic plants to troposphere.

Methane gas was collected over the water surface by employing a locally fabricated floating gas collection system. For measuring CH_4 efflux from ponds/lakes, this system was floated on the water surface and the air samples were collected by an air pump in the teflon-coated



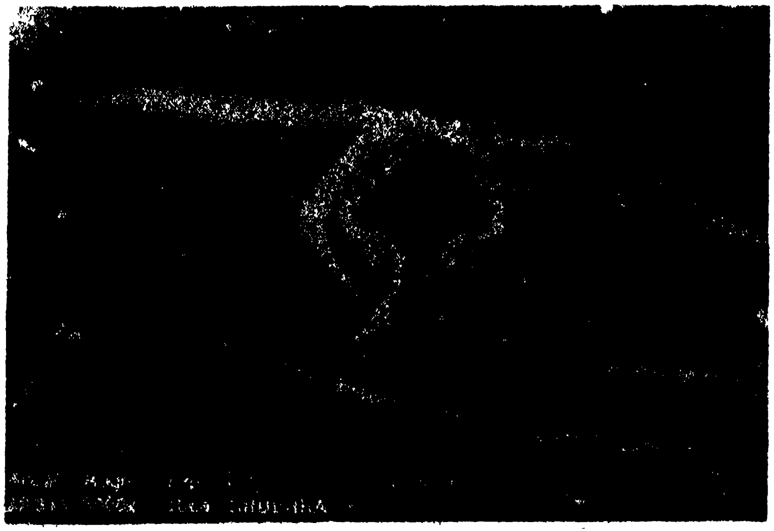
Methane efflux from wetlands being measured using the floating device, and seasonal changes in methane emission from the vegetated surface of water bodies tedlar bags at certain intervals. These samples were analyzed for methane concentration with a computerized gas chromatograph, using FID detector and molecular sieve column (5Å). Operating conditions for methane analysis were oven temperature 90°C, detector temperature 120°C and injection temperature 120°C which detected methane peak at the retention time 2.6 min. In the case of flux measurement from paddy fields, a static teflon chamber was used.

Measurement of methane efflux from ten water bodies (both natural and man-made) of Lucknow city and adjoining areas (namely Gomti river, Chinhat lake, Surajkund, Butler Palace pond, Navabganj lake, NBRI Garden pond, Bakshi-ka-Talab, Hussainabad tank, Buddha Park tank and Motijhil) in three different seasons showed seasonal fluctuations in methane emission pattern. In Gomti river and Chinhat lake, the maximum CH_4 emission rate was recorded in the winter season, followed by the summer season and least in the rainy season. However, other water bodies did not strictly follow this trend. Among all the water bodies investigated, Gomti river showed maximum CH_4 efflux (14.92 mg/m^2/h) while minimum efflux (-1.54 mg/m^2/h) was recorded in Surajkund in the winter season, indicating that its sediment was acting as a sink instead of a source for CH_4 at the time of flux measurement. The data also indicated that there was a significant difference in the CH_4 emission rates from the vegetated and unvegetated surfaces of the same water body. It was observed that in the winter season, CH_4 emission was 13.86 mg/m^2/h from the vegetated surface and 1.05 mg/m^2/h from the unvegetated surface of Jamuna Jhil. This clearly indicates that the methane emission to the atmosphere is mainly mediated through aquatic plants, particularly those rooted into the sediments. It is also evident that free floating plants cannot act as chimneys for CH_4 transport from the sediments to the atmosphere. That is why despite the presence of free floating plants, some water bodies did not show any significant CH_4 emission from their water surfaces.

The methane emission was directly correlated with organic carbon content of the sediments (the CH_4 formation is the last step of anaerobic decomposition of organic matter). It was observed that the Gomti river, in which maximum CH_4 emission was recorded, had also maximum organic carbon content (0.82%) in the sediments. However, Butler Palace pond and Moti Jhil did not exhibit higher rate of CH_4 emission, although there was considerably high amount of organic carbon in their sediments. This indicates that CH_4 generation does not absolutely depend on the organic carbon content but also on the chemical nature of the organic waste.

Besides, CH_4 production and emission were based on the redox potential of the sediments which had to be necessarily lower than -150 mv to favour methanogenesis process. The data show that the water bodies whose sediments are more reduced (lower redox potential) exhibit higher rates of CH_4 emission. However, no apparent relationship was found between the CH_4 emission and other parameters of the sediments like *p*H and the temperature of the water bodies which varied marginally only.

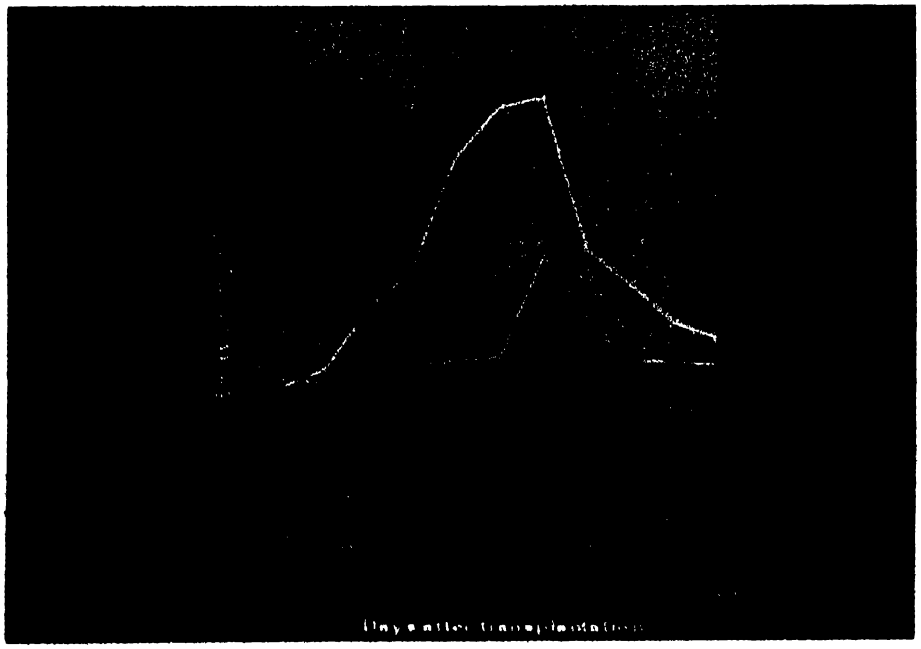
Out of 15 aquatic plant species (commonly growing in these ponds) examined under scanning electron microscope (SEM), nine species — *Potamogeton factinatus, Nymphaea alba, Ceratopteris thalictroides, Limananthemum cristatum, Schoenoplectus subalatus, Hygrorhyza aristata, Ceratophyllum demersum, Bacopa monnieri* and *Hydrilla verticillata* — showed the presence of circular or slit like pores which were



A scanning electron micrograph of micropore present on the tiller of *Schoenoplectus subalatus* (Vahl) K. Lye different from the stomata. Shown in the figure is an SEM micrograph of a micropore present on the tiller of *Schoenoplectus subalatus.* The frequency of such micropores was found to be very high on the tiller just above the water surface, indicating maximum CH_4 efflux in this region. These micropores are thought to be probable ports of methane emission. Studies are being carried out to confirm this through their connection to petiole and stem aerenchyma of the aquatic plants. These micropores were reported first time on the abaxial surface of leaf sheaths of rice plants in 1990.

Surprisingly, physiological processes like the photosynthesis, transpiration and stomatal conductance did not have any impact on methane emission rate, proving that methane emission is independent of physiological processes.

In an experiment set-up, paddy crop (var. Vishnuparag) was treated with different kinds of organic manures like rice straw, leaf manure, cowdung manure and a biofertilizer to study their effect on methane emission. Periodic measurement of methane efflux at weekly intervals was carried out. It was observed that the biofertilizer which is commonly applied in rice-fields to fix atmospheric N_2, tremendously enhanced methane emission, more than even rice straw which is so far known to be a inducer of methane generation because of its high C/N ratio. However, minimum methane efflux was recorded from the rice-fields treated with cowdung manure and leaf manure. It was also noted that methane emission was initially very low due to upland conditions which perhaps did not favour methanogenesis process owing to high redox potential of the sediments, and reached to the peak level in 56 days after transplantation at heading stage, irrespective of the treatment. At this stage, root exudates, which serve as substrates for CH_4 formation, are released to the maximum extent due to rapid extension of root mats in the sediments. It is likely that nitrogen fixing organisms (biofertilizer) enhance the methane generation and emission through N and organic C input to the soils.



Seasonal fluctuations in methane efflux from the paddy fields treated with different organic manures

The ongoing studies under the project are expected to throw light on mechanism of CH_4 transport through aquatic plants. An annual methane budget of wetlands, which is proposed to be prepared at the end of the project, will supplement the data needed for preparation of CH_4 budget at national and international levels. ❑

Genotype X environment interaction in opium poppy

THE Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, has carried out a study for over two consecutive years with nineteen populations of opium poppy (*Papaver somniferum L.*) (eleven from Rajasthan, four from Madhya Pradesh, two from Delhi and two from Uttar Pradesh), for their performance with respect to major economic characters. Data on flowering time, plant height, peduncle length, capsules/plant, capsule index, latex yield, seed yield and morphine percentage were subjected to genetic divergence analysis.

Composition of each cluster was found to differ in both the years indicating the role of genotype x environment interactions on genetic divergence.

Such differences in composition of clusters of genotypes have been also reported in other crops. It was observed that plant height was strongly and positively correlated with peduncle length and latex yield and negatively with capsule index.

As different genotypes clustered in a different way in both the environments of two consecutive years, it is suggested that composition of cluster in one environment may not be applicable in another environment. ❑

TRAINING PROGRAMMES

Floricraft & Floriculture

A five-day training programme on 'Floricraft & Floriculture' was organized by the CSIR Polytechnology Transfer Centre (PTC), Bhopal, from 12 to 16 May 1997, at its premises. Sponsored by the M.P. Council of Science & Technology, the programme was conducted mainly with a view to generating employment potential among women.

Smt. Nirmala Buch, ex-Chief Secretary, Government of M.P. and presently Chairperson, Mahila Chetna Manch, inaugurated the programme. In her address she praised the efforts of PTC-Bhopal, because of which several industries had been set up in and around Madhya Pradesh. Floricraft, which can be used to produce greeting cards, visiting cards, paper weights and a large number of other decorative items, can be a very good profession as well as hobby for women, she said. She also suggested to form a cluster of women who should collectively work for creating a sustainable and durable market for these products.

Dr Ram Prasad, Director General, MPCOST, who presided over the inaugural session, assured all possible help from the Council to conduct such programmes in other parts of Madhya Pradesh. Earlier, Shri M.S. Virdi, Project Officer & Head PTC—Bhopal, welcomed the participants and delegates and apprised them about the objectives and aims of the programme.

Dr J.C. Bhutani, ex-Scientist, National Botanical Research Institute (NBRI), Lucknow, who is an Floricraft & Floriculture expert, gave introductory remarks about the programme. The vote of thanks was proposed by Shri K.K.Kaul, Scientist, PTC-Bhopal.

Forty women participants attended the programme conducted by Dr J.C. Bhutani, which included theory as well as practical sessions. The trainees also produced various floricraft products themselves to gain confidence.

Top: Dr Ram Prasad, Director General, MPCOST, delivering his presidential address at the training programme on Floricraft & Floriculture. Seated on the dais (from left) are: Shri M.S. Virdi, Project Officer, PTC-Bhopal and Smt. Nirmala Buch, ex- Chief Secretary, Government of Madhya Pradesh. *Above*: A view of one of the training sessions

A separate session of Floriculture was also arranged for male entreprenuers.

The valedictory session was presided over by Shri U.K. Varma, IAS. Industries Commissioner. Government of Madhya Pradesh, who made a request to conduct similar programme at Ujjain — the City of Flowers. He also distrubuted certificates to the trainees. ❑

Lead - Acid Batteries

THE CSIR Polytechnology Transfer Centre (PTC) Bhopal, in collaboration with the Central Electrochemical Research Institute (CECRI), Karaikudi and Centre for Entrepreneurship Development. Bhopal, organized a 5-day training programme during 5-9 May 1997 on Fabrication of Lead-Acid Batteries, in the premises of M/s Power Batteries, Indore. Prof. N.K. Dhakad, Proprietor of the firm, who had undergone training in the fabrication of bateries at CECRI several years ago, played the leader's role for the 45 entrepreneurs interested in setting up new units or diversifying the existing units. The programme was sponsored by Department of Science & Technology, Government of India, New Delhi.

Inaugurating the programme, Shri M.S. Virdi, Project Officer & Head, PTC-Bhopal, spoke about CECRI technologies which had been transferred to Madhya Pradesh and also the new ones which have good scope for their absorption in the state, like that for maintenance-free batteries for emergency lights. Dr Alagappa, Team Leader from CECRI, gave details of the programme. Shri Reddy, Area Co-ordinator of MPCED proposed a vote of thanks. The programme was highly appreciated by the participants and industrialists. ❑

DOCTORATES

Air Gasification of Jute Stick

BIOMASS gasification is associated with numerous physical and chemical changes in a reactor having four predominant zones, namely drying, pyrolysis, oxidation and reduction; the order being dependent on mode of operation such as co-current, counter- current or cross current. Producer gas, the ultimate desired product, contains mostly carbon monoxide. Raw material properties and intermediate products in many cases affect operation, maintenance and product quality.

An investigatory work was undertaken at the Central Glass & Ceramic Research Institute (CGCRI), Calcutta, to ascertain the suitability and develop a mathematical model for air gasification of jute stick which is abundantly available in India, particularly in the Eastern region. Its low ash content and particle size are less troublesome for the gasification process.

A detailed characterization study showed that jute stick having a heating value of 19.45 MJ/kg, contains only 1.7% of ash; the temperature of complete pyrolysis being 750°C.

In the moving bed reactor, studies were carried out mainly with two type of feedstocks, feeding packed bundles of jute stick stems longitudinally inside the reactor, i.e. regular packing, and feeding jute stick pieces of certain size and shape, i.e. random packing.

Updraft and a downdraft gasifiers of capacity 5 kg/h solid each were designed and developed. Diameter and height of the reactor, the two important features of the reactor, were designed with a view to maintaining solid gasification rate of 150-250 kg/(m^2.h) and residence time to maximize the gaseous output respectively. The downdraft gasifier was also provided a suitably designed gas cleaning train.

Operation and performace studies revealed that the final gas having high tar content in updraft operation could find its best use in direct burning. The final gas in a downdraft gasifier contained only 1 g/Nm^3 tar which could be brought down to 0.16 g/Nm^3 via gas cleaning operation for its normal use. Average gas output and calorific value were 1.5 Sm^3/kg and 4.5 MJ/Sm^3 respectively, maximum temperature measured in the gasifier being 1250°C. Continuous operation of reactor for several hours still remained a problem, both in terms of stability of the reactor and quality of the output gas.

Mechanistic mathematical models for each type of reactor were developed under non-equilibrium conditions. Diffusion mechanism prevailed over mass transfer and chemical kinetics in the reaction processes. The models with shrinking core assumptions and Knudsen diffusivity as the parameter identified a few non- dimensional numbers containing the process variables in the simultaneous polynomic differential equations of nth order with variable coefficients. The curvature for the unburnt carbon along the reactor in the burning zone was like a bisected hyperboloid with coincided extrimities. The generated stream temperature profile is in the shape of one side tapered paraboloid with downward concavity. The experimental studies have thus established that the model can become a tool for design simulation, scaling up and process control of a gasification system.

The above study was made by Shri Tarun Kumar Kayal, Scientist, CGCRI, under the joint supervision of Dr M. Chakravarty, Scientist, CGCRI and Prof. G.K. Biswas, Chemical Engineering Department, Jadavpur University. Shri Kayal was awarded Ph.D. (Engg.) degree by the Jadavpur University, for this work. ❑

Supported Vanadium Oxide Catalysts for Selective Oxidation of 4-MethylAnisole

P-Anisaldehyde (4-methoxybenzaldehyde) is an important intermediate in the pharmaceutical and perfumery industry. Benzaldehyde and substituted benzaldehydes can be synthesized from toluene and substituted toluenes in liquid phase in the presence of Co, Ce, and Mn salts in acetic acid medium or by electrochemical methods. However, these routes are not highly efficient and economical. Some of these selective oxidations can be carried out in vapour phase using a suitable heterogeneous catalyst system, which has several advantages over the liquid phase route. However, such attempts have been quite limited.

Shri M. Vijay Kumar while working at the Indian Institute of Chemical Technology (IICT), Hyderabad, made a systematic study to develop an efficient catalyst system for the selective conversion of 4-methylanisole to anisaldehyde. An additional objective of this study was to obtain an insight into the structure of the catalyst and relationship between this structure and the catalytic activity.

Preliminary investigations on well proven supported vanadia and molybdena-based catalysts revealed that a balanced combination of an acidic oxide such as V_2O_5 and a basic oxide such as MgO is very effective for selective conversion of 4-methylanisole to anisaldehyde. Recently it has been shown that the V_2O_5-MgO oxides are very active and selective for the oxidative dehydrogenation of butane, propane and cyclohexane respectively. Therefore, more attention was focused on V_2O_5/MgO, V_2O_5/CaO-MgO and V_2O_5/MgO-Al_2O_3 based catalyst systems. In this investigation, a series of MgO, CaO-MgO and MgO-Al_2O_3 supports and various vanadia-containing catalysts were prepared and characterized by means of several physico-chemical techniques like XRD, FTIR, ESR, DTA, TGA, SEM, ammonia uptake, CO_2 chemisorption and BET surface methods and were tested for the selective oxidation of 4-methylanisole to *p*-anisaldehyde.

The activity studies on V_2O_5/MgO catalysts revealed that the 20 wt% V_2O_5/MgO catalyst is more active and selective than other combinations. It was found from the characterization studies that high selectivity to anisaldehyde over V-Mg-O catalyst is due to the intimate presence of both vanadium oxide and magnesium oxide on the surface of the catalyst. The MgO modifies the acidic property of vanadium oxide and reduces the reactivity and density of surface V=O species in order to produce more selective oxidation products. More selectivity towards anisaldehyde was observed on V_2O_5/CaO-MgO catalyst than on V_2O_5/MgO. The detailed characterization studies revealed that MgO and CaO-MgO oxides stabilize the active vanadium oxide species differently. MgO stabilizes V^{4+} species, namely $(V{=}O)^{2+}$, regardless of the inorganic matrices present in the composition, and the CaO is less active than MgO in stabilizing V^{4+} species. This behaviour can be ascribed to the ability of the more defective MgO structure to stabilize 'guest ions' in a reduced state through its electronic vacancies. In other words the V^{4+} species are more stabilized in V_2O_5/CaO-MgO catalysts than in V_2O_5/MgO. The NH_3 and CO_2 chemisorption measurements revealed that CaO-MgO is more basic than MgO. The CaO-MgO not only shows more basicity but also exhibits some structural deformation which leads to higher catalytic activity and selectivity than other systems studied.

Magnesium oxide with high surface area can be prepared by calcination of magnesium hydroxide in vacuum. Calcination in open air atmosphere, which is preferable from a practical point of view, often results in low surface area because of sintering of the newly formed small magnesium oxide crystallites in the presence of water vapour produced upon decomposition of magnesium hydroxide. Subjection of high surface area magnesia to even small amounts of steam at elevated temperatures during the course of reaction also causes a dramatic loss in surface area. To make a highly stabilized and high surface area magnesia, alumina was incorporated. However, these catalysts exhibited poor selectivity with high conversion. The low selectivity of these systems are explained on the basis of low reducibility of V^{5+} species in V_2O_5/MgO-Al_2O_3 catalysts. These catalysts also exhibited an acidic character and their acidity was found to be higher than that of V_2O_5/MgO and V_2O_5/CaO-MgO. The high acidic nature of the V_2O_5/MgO-Al_2O_3 catalysts was reflected in their high conversion of

4-methylanisole and low selectivity for the desired oxidation product anisaldehyde.

Shri Vijaya Kumar carried out these studies under the supervision of Dr B.M. Reddy, Assistant Director, Inorganic Chemistry Division, IICT, and was awarded Ph.D. degree in Chemistry by the Osmania University. ☐

Polymer Bound Porphyrin and Thionine

SHRI E. Balasubramaniam, Research Associate at the Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, has been awarded Ph.D. degree by the Bhavnagar University for his thesis entitled 'Synthesis, Characterization & Photochemical Studies of Polymer Bound Porphyrin and Thionine', in December 1996. He carried out this Ph.D. research work under the guidance of Prof. P. Natarajan, Director, CSMCRI. ☐

ANNOUNCEMENTS

NAL-UNI LECTURE SERIES

Aircraft Flight Control and Simulation

THE title lecture series will be held during 26-29 August 1997 at the FMCD Conference Hall, National Aerospace Laboratories, Kodihalli Campus, Bangalore. The main objective of this lecture series is to bring out the problems and describe the practical aspects related to design, development and testing of flight control laws for modern high performance aircraft. This set of lectures will include topics related to command and stability augmentation systems, handling qualities evaluation, aircraft pilot coupling, structural coupling, notch filter design, autopilot laws, etc.

The lectures will highlight the important role played by flight simulation at various stages of the overall design and development cycle — an area not often emphasized or covered in traditional classroom lectures. The faculty is drawn from the very people who have played a key role in the design of the flight control laws for an aerodynamically unstable aircraft currently under development.

Eligibility: Scientists, practising engineers and students with B.E./M.E. in aerospace/control/electrical/electronics engineering.

Course Fee: Rs 2000

Intake: 35 participants by registration only. Applications to be submitted in the prescribed form along with the course fee to the Convener, NAL-UNI Series.

Course Coverage

Flight Simulation

●Introduction to flight simulation ●Equations of motion, aerodynamic modelling for simulation and flight control system design●Subsystems modelling for simulation ●Equilibrium analysis, linear model generation, flight mechanics parameter ●Aircraft dynamics and stability●Visual cueing and man-machine interface●Inflight simulation.

Flight Control

●Aircraft flight control/handling qualities/aircraft pilot interaction - an overview●Case study - flight control design example●Alternative synthesis techniques applied to flight control●Aero servo elasticity, structural coupling, notch filter design●Fundamentals of autopilot design.

Practical Demonstrations

●Engineer-in-loop simulator ●Linearizing link software ●Control law synthesis●HQPACK software for HQ's and API evaluation.

Course Coordinators: Shyam Chetty and Padma Madhuranath.

For further details please contact: Dr G. Prathap, Convener, NAL-UNI Programme or Shri M.R. Narasimha Swamy, Head, Technical Secretariat, National Aerospace Laboratories, Post Bag No. 1779, Bangalore 560017. Tel: 080-5273351, 5271112, Fax: 080-5260862, Telex: 0845-2279 NAL IN. ☐

CMRI Liaison Services Renamed

IN a bid to provide proper boost to the transfer of technology from the laboratory to the mining industry and manufacturers of mining equipment, the Liaison Services of the Central Mining Research Institute (CMRI), Dhanabd, have been invigorated by creating a Marketing and Intellectual Property Right Cell under its fold. And the institute's Liaison Services have been renamed as Business Development, Information and Liaison Services. This would not only make the concerned indigenous industries competitive with their foreign counterparts but also help CMRI earn more, in tune with the present policy of CSIR. ☐

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit

Annual Subscription : Rs. 60
Editor : Dr B.C. Kashyap
Editorial Assistant : Neelima Handoo
Production : Kaushal Kishore
Single Copy : Rs. 3.00
Telex : 031 77271
E-mail: niscom@sirnetd.ernet.in.
Fax : 5787062

ISSN 0409-7467

CSIR NEWS

NCL wins Indonesian Consultancy Contract against Global Competition : A Repeat Performance

THE National Chemical Laboratory (NCL), Pune, has won an Indonesian consultancy contract against stiff global competition. NCL's competitors in this assignment were world renowned R&D and consultancy companies from Europe and Asia-Pacific. This contract comes to NCL in view of its successful track record in R&D management, technology development and industrial interactions.

The Ministry of Industry and Trade, Republic of Indonesia, had applied to the World Bank for a loan to finance the Industrial Technology Development Project. Consultancy services were required to strengthen the research and development capabilities of R&D institutions in Indonesia. The Ministry of Industry and Trade in consultation with World Bank has selected NCL to provide these advisory services for the Institute for Research and Development of Chemical Industry (IRDCI), Jakarta.

NCL will identify focussed technological development projects relevant to the needs of Indonesia, ascertain programme requirements and implementation strategies and make a comprehensive plan for upgrading IRDCI.

It may be recalled that NCL had won similar contract a few years ago from China. Today NCL has among its clients some of the leading multinationals in the world. ❑

After signing the agreement for Indonesian consultancy contract *(from left)* : Mr Kurnia Hanafiah, Project Coordinator (IRDCI); Dr H. Soewadji, Director (IRDCI); and Mr R.R. Hirwani, Head, Business Development, NCL

R&D on Speech Technology at CEERI

IN view of the inherent superiority of speech over other modes of communication, speech tech

Testing of a speech recognition board

ogy is playing a vital role in providing seamless, easy to use, high quality and affordable communication services. It is enabling people and computer systems/machines to talk to each other in spoken natural language. The Central Electronics Engineering Research Institute (CEERI), Pilani, has been working in three major areas, viz. Speech Recognition, Speech Database Development and Speech Synthesis. It is envisaged to develop systems for Indian spoken languages starting with Hindi. This calls for an inter-disciplinary research into the mechanisms of human speech production and perception as well as computationally effective procedures for acoustic signal processing, pattern recognition, language understanding, etc. Many of the projects taken up in these areas have been sponsored and supported by DoE and UNDP.

Significant Achievements

CEERI has developed for the first time in India:

- Different models of Isolated Word Recognition System (IWRS) using Z-80 and Motorola 68000 microprocessors (i) IWRS for 10 words with an accuracy of 99% and (ii) IWRS for 50 words with an accuracy of 90%.
- A working model of Hindi text to speech synthesis system using cascade/parallel formant synthesizer.
- An acoustic phonetic database of Hindi speech.

Ongoing Projects

Speech Recognition: CEERI has taken up the development of speech recognition systems in a phased manner. The approach is to develop standalone portable gadgets which work in real time for application in controlling machines, information retrieval systems and aids for the disabled.

The speech signal picked up by the head microphone is pre-processed using a 16-channel filter bank, multiplexer, digitizer, etc. The original data acquired from the pre-processor at the rate of 3200 bytes/second is compressed to only 16 bytes/second through data compression techniques. The compressed data are used for recognizing a small vocabulary of 10 words using city block distance comparison method without sacrificing any recognition accuracy.

Both Linear Time Warping (LTW) using city block distance measurement and the techniques of Dynamic Time Warping (DTW) have been used for matching the reference and test templates of the words. Techniques of word rejection for improving the speed of word recognition process have also been incorporated.

Laboratory models and field prototypes of different versions of IWRS have been successfully tested.

Speech Database Development: An important aspect in speech research is to tackle the problem of variability of the acoustic characteristics of the phonemes (speech segments). These characteristics vary from speaker to speaker, pronunciation, co-articulation effects in a sentence, environmental noise, health conditions, mood of the speaker, etc. A large database of acoustic, phonetic and prosodic parameters is essential to understand the acoustic variability that occurs under different conditions.

CEERI in collaboration with Tata Institute for Fundamental Research (TIFR), Mumbai, has been engaged in the development of databases for spoken Hindi. These include databases for Hindi words, digits and phonemes.

It has developed digital as well as acoustic phonetic database for a task specific vocabulary for developing voice-controlled railway reservation enquiry system.

Speech Synthesis and Text to Speech Conversion: Speech synthesis research is being done to artificially generate intelligible and natural sounding voice for conveying information. Speech can be synthesized preferably in a desired accent, language and voice type (male, female or children).

CEERI has been concentrating on the development of an unlimited text to speech conversion system with high quality synthetic speech for Hindi. Its adaptability for other Indian languages is being explored.

Two major techniques used to synthesize speech are: (i) Synthesis from pre-stored speech and (ii) Modelling the voice source and the speaking mechanism which in turn contains two categories, i.e. Articulatory Synthesizers and Formant Synthesizers.

A cascade/parallel formant synthesizer has been simulated on a PC platform. A set of about 60 parameters (12 consonants and 48 variables) representing the source and vocal tract configuration at a particular time has been used for creating the synthesized file. Depending upon the nature and type of speech sounds, the selected parameters can be varied in time domain (usually after every 10 milli sec) till a satisfactory quality of synthetic sound is generated.

In the CEERI Text to Speech System (TTS), mono-syllables have been chosen as the basic units of Hindi speech to synthesize unlimited speech. The database consists of consonant vowel (CV), vowel consonant (VC), consonant clusters and geminates, etc. made by combining all frequently occurring consonant and vowel sounds of Hindi. About 700 basic units (syllables) would be adequate to generate unlimited speech.

The text input fed from the keyboard of a PC is first converted into a sequence of phonetic symbols. Numerals, abbreviations and punctuation marks, etc. are also converted into suitable phonetic codes which are then fed to a word parser. The word parser identifies the basic units of sounds, i.e. syllables available in the database from which the words are generated.

The concatenator merges the files received from the database and generates a new parametric file for the given input word. The quality of the merged sound file is not very good because of discontinuities in the parameters of sounds at the boundaries. Their timing, intonation and loudness patterns are also not the same as that of a natural utterance. A knowledge base of duration, intensity pitch and frequency rules is provided to the Voice Quality Manager (VQM). The latter applies these rules to the parametric file received from the concatenator and feeds it to the synthesizer to generate a better quality synthetic file of the text word.

Voice-operated wheel chair

Applications

There are a number of practical applications of speech input and output devices. The speech recognition and synthesis systems being developed by CEERI can be used in different applications such as control & communication systems, aids for disabled, etc. In this direction, CEERI has already been developing a voice-operated motorized wheelchair for the disabled.

Collaborations

CEERI has research collaboration with MIT, USA for developing 'Text to Speech Synthesis System for Hindi', and with TIFR for developing Speech Database.

Future Plans

CEERI is continuing its efforts to develop comprehensive speech databases and systems for voice-operated information services, speaker verification, machine translation, and multi model communication using Indian spoken languages. ❑

New Sponsored Projects at CEERI

Electronic Monitoring & Control System for Mushroom Cultivation

THIS project has been sponsored by the Department of Electronics (Amount: Rs 2.88 million), at the Central Electronics Engineering Research Institute (CEERI), Pilani, with the objective to develop instrumentation and control system for compost preparation and cropping process stages of mushroom cultivation.

Brief Description: Mushroom cultivation has different stages such as compost preparation, spawn preparation, casing soil preparation, spawn run, casing and cropping. The project involves the development and field testing of monitoring and control system for two stages, viz. compost preparation and cropping. These call for the monitoring and control of different environmental parameters such as temperature, relative humidity, CO_2, O_2, moisture, *p*H, etc.

Suitable electronic gadgets for monitoring these parameters would be developed as per the application requirements. These gadgets would have suitable hardware to interface with an industrial PC equipped with appropriate data acquisition system. The necessary interface circuits will be developed to drive the final control elements that regulate the supply of fresh air, steam, etc. to the process.

Application software will be developed for acquiring process information and its analysis. The knowledge thus acquired and from other sources would be utilized to identify and develop suitable control strategies. User-friendly operator's interface will be provided with appropriate mimic diagrams, trend graphs, etc. Performance data will be logged to have a mechanism to the domain experts to analyze and refine the settings of different environmental parameters and control strategies, which in turn, would lead to better quality and higher yields of mushrooms.

C-band 60W (CW) Space TWT

Under this ISRO Satellite Centre, Bangalore-sponsored project (Amount : Rs 6.6 million), CEERI would carry out design of high efficiency C-band 60W (CW) helix TWT for space application, and develop and fabricate six space-qualified TWTs, in association with Bharat Electronics, Bangalore.

Brief Description: Travelling Wave Tubes (TWTs) are used by Indian Space Research Organisation in their INSAT and other geo-synchronous satellites for communication purpose. These space-qualified TWTs are required to have very high efficiency, high linearity, high reliability, long life, small size and less weight. For achieving self-reliance in this field, ISRO has approved a collaborative project among CEERI, Bharat Electronics and ISRO Satellite Centre, for design and manufacture of the space TWTs. An MoU in this regard has been signed by the three organizations in March 1997. ISRO has requirements of space TWTs in L, S, C, X and Ku bands. The present project has been taken up for the development of the C-band 60W (CW) TWT.

The duration of the project is 30 months and six tubes are expected to be supplied to ISRO. The development of sub-assemblies and complete tube will be taken up jointly by CEERI and Bharat Electronics. The total cost of the project is Rs 27 million, out of which CEERI will get Rs 6.6 million.

PWM Amplifier and Electronics for Electromechanical Actuator

Sponsored by The Naval Science & Technological Laboratory (NSTL). Visakhapatnam (Amount Rs 2.25 million), the objective of this project is to design, develop and supply the PWM amplifier and electronics for actuation system.

Brief Description: An actuator is used for precise control of a shaft or surface position. Electromechanical actuators use electric motor and gear combination to move the surface to desired position. A power amplifier, a position feedback element and electronics for the closed loop are essential parts of a position control system. Pulse width modulated (PWM) power amplifier is preferred over linear amplifier because of its compact size and high efficiency.

CEERI has accepted the task of design, development and fabrication of PWM amplifier and electronics for the actuation system as per specifications of NSTL. The first prototype would be delivered in three months. After acceptance of prototype, a supply of 10 systems would be made to NSTL within a year.

Brief system specifications:

Input DC Voltage	40 V
Load torque	8 kg-metre
Closed loop bandwidth	$\geq$5 Hz
Peak overshoot	< 110%
Position Control span	±20 degrees

❑

Agreements signed by IICT

THE Indian Institute of Chemical Technology (IICT), Hyderabad, has signed, in the recent past, the following agreements with various national/international firms/R&D organizations for collaborative work:

SPIC (R&D) — For joint Development of Pyrazinamide and Allied Technologies under PATCHER (DSIR) Programme

A comprehensive agreement has been signed by IICT, SPIC and NRDC to facilitate joint process development by IICT and SPIC-R&D

Centre, Tuticorin, for a range of pyridine- and picoline-based chemicals including pyrazinamide. It is an important anti-TB drug with good domestic and export market potential. A continuous process pilot plant with fixed bed reactor and downstream processing units will be set up at Tuticorin for scale up studies. The catalysts developed by IICT and SPIC-R&D Centre will first be assessed jointly in micro reactor facilities to be set up at the respective institutions. Ammoxidation, condensation and hydrolysis are the main unit processes to be encountered in the proposed technology. The total project cost is about Rs 40 million with nearly 45% of the cost being provided by DSIR as an interest-free loan to SPIC. The total duration of the project is two years.

IOC — For Collaboration for the Development of New Oleochemical-based Biodegradable Lubricants

In a unique programme, the R&D Centre of the Indian Oil Corporation, Faridabad and IICT will develop sixteen types of biodegradable lubricants from vegetable oils. This project is significant since renewable resources are being explored to replace synthetic lubricants from petroleum feedstocks. IICT will develop the lubricants and IOC will subject them to comprehensive testing in their R&D Centre at Faridabad. The total duration of the product development activity is 18 months and process development work will be undertaken subsequently as a second phase activity.

KSCCF — For Technology Package for Activated Carbon from Coconut Wastes

IICT has signed an agreement with M/s Karnataka State Coir Cooperative Federation Ltd (KSCCF), Bangalore, for revival of its activated carbon plant at Arisekere. Under the agreement, IICT will provide engineering package with turnkey services to KSCCF to manufacture two tonnes/day activated carbon from coconut shell char, and also to manufacture coir pith char briquettes. The project, with a total cost of Rs 24 million, is proposed to be implemented by IICT on turnkey basis in four phases over a period of 30 months.

RRL - Bhubaneswar — For Partnership in Nickel Project

The Regional Research Laboratory (RRL), Bhubaneswar, in association with IICT, Central Electrochemical Research Institute (CECRI), Karaikudi and National Metallurgical Laboratory (NML), Jamshedpur has formed a consortium to develop a commercially viable process to extract nickel metal from low-grade chromite mine waste.

For exploitation of the nickel technology, an MoU has been signed by Dr R.A. Mashelkar, Director General, CSIR and Shri K.V.K. Seshavataram, Chairman and Managing Director, Hindustan Zinc Ltd (HZL), Udaipur — a multi-unit mining and smelting company having a vast experience in non-ferrous metal extraction. As per the terms of MoU, CSIR and HZL will jointly establish and operate a 10 tonnes/day technology proving plant (TPP). IICT will provide detailed engineering package for the TPP which will be managed by a Governing Council comprising experts from HZL, CSIR, Orissa Mining Corporation and Tata Steel. On successful operation of the TPP, a 10,000 tonnes/annum nickel plant will be established at an estimated cost of Rs 7000 million. On completion of this project, India will be able to utilize much of its 200 million tonnes of chromite mine waste (overburden) with low nickel content available at Sukinda region of Orissa thereby reducing nickel imports.

NCI/NIH (USA) — For Anti-Cancer and Anti-AIDS Drug Testing

IICT renewed its agreement on screening of new molecules for anti-cancer and anti-AIDS with National Cancer Institute (NCI)/National Institute of Health (NIH), Bethesda, USA. The agreement was signed by Dr K.V. Raghavan, Director, IICT and Dr Ven L. Narayanan, Chief, Drug Synthesis and Chemistry Branch, NIH at Hyderabad. Earlier also, IICT had entered into an agreement with NIH for screening of new drug molecules synthesized in its laboratories for anti-cancer and anti-AIDS activities.

DuPont (USA) — To jointly work for the Development of New Molecules for Potential Agrochemical Applications

IICT and DuPont (USA) have renewed the contract in December 1996 for a period of two years, to jointly work for the development of new molecules for potential agrochemical applications. The agreement was signed by Dr K.V. Raghavan, Director, IICT and Dr Wolf, DuPont at the Delaware R&D Centre of Dupont in USA.

CYTOMED Corporation (USA) — For Study of a New Process for a Proprietary Compound

IICT and CYTOMED entered into a one-year research contract in February 1997. It covers the study of new chemistry and process on laboratory scale and extensive chemical characterization.

SEARLE R&D (USA) — For Chemical Synthesis of Its Proprietary Compounds

The agreement signed in March 1997 envisages, synthesis of proprietary compounds of Searle R&D by IICT through a time bound contract involving micro synthesis and characterization.

Other Contracts

During October 1996 to March 1997, IICT has entered into agreements with several other important industrial houses. These have been mentioned in Table - 1. ❑

Table - 1

Technology	Industrial House
• Lamivudine (anti-viral drug)	CIPLA, Mumbai
• Ethionamide (anti-TB drug)	Radicura Pharmaceuticals Pvt.Ltd, New Delhi
• 10-Undecenoic acid and heptaldehyde from castor oil pyrolysis	Sarvans Chemicals India Ltd, Mumbai
• Photocatalytic degradation of industrial wastewater	Jeedimetla Effluent Treatment Ltd, Hyderabad
• Coir Panels	Shree Malani Industries, Hyderabad
• Flurbiprofen and Nabumeton	Sumitra Pharmaceuticals and Chemicals Ltd, Hyderabad
• Photocatalytic oxidative degradation of industrial waste water	Voltas Ltd, Patancheru
• BOPP and other adhesives	Preetam Nitrates Ltd, Hyderabad
• Acephate and Esfenvalerate	TIFAC (DST)
• Acrylic copolymer adhesive	Preetam Nitrates Ltd, Hyderabad
Consultancy Assignments	
• Design Engineering	Radicura Pharmaceuticals Ltd, New Delhi
• Bioefficacy Study	i. Reckitt and Colman of India Ltd, Mumbai ii. Cyanamide India Ltd, Mumbai iii. Shield Insulation Pvt.Ltd, Pune
• Toxicity Studies	Intrinsic Marketing, Hyderabad

NATIONAL METALLURGICAL LABORATORY, JAMSHEDPUR
R&D Highlights: 1995-96

THE National Metallurgical Laboratory (NML), Jamshedpur's R&D activities fall into the following four major areas: (i) Industrial Processes -- Mineral Beneficiation, Extraction of Metals, Development of Refractories and Process Fundamentals and Modelling; (ii) Engineered Materials -- Synthesis and Development of Materials, and Forming Processes and Microstructure of Materials; (iii) Resource and Environment Conservation -- Waste Utilization, Secondary Metals Recycling, Corrosion Protection, Component Integrity Evaluation and Pollution Control; and (iv) Accreditation of Testing/Calibration Facilities, Analytical Testing, Mechanical Testing, Nondestructive Evaluation, Corrosion Testing and Development and Maintenance of Electronic Database for Materials.

During 1995-96, the number of ongoing projects under the various categories were: collaborative - 15 (including three international collaborations), thrust area - 2, sponsored - 14, grant-in-aid- 13, consultancy-10, exploratory-32 and technical services-5. The projects completed include: collaborative-2, sponsored-21, grant-in-aid-2, consultancy-17, exploratory - 27, and technical services-1. The technologies marketed during the year included: Corrosion and scale inhibitor (M/s Kesal Chemicals and Pigments, Calcutta), Inhibitor for use in HC1 pickling of metals (M/s Deepak Brothers, Nagpur), Radiator Coolant -- PR1XOL (M/s P.G. Enterprises, Jamshedpur), and Galvanizing flux for hot dip zinc coating (M/s Bihar Adityapur Dies, Jamshedpur). Of these, the technology for PRIXOL

PRIXOL -- the radiator coolant launched in the market by M/s P.G. Enterprises based on the NML technology

was commercialized and the product launched into the market. This coolant is used in both light and heavy vehicles and is strongly recommended by TELCO and Maruti Udyog.

Several other technologies in the areas of metal powders, pollution control, waste utilization and software for industrial applications were ready for release.

A few of the major projects pursued during the year are highlighted here:

International Collaborative Projects

The three international collaborative projects are:

Beneficiation and Zinc Extraction Studies on Ganesh Himal Ore Bench scale studies were carried out for M/s Nepal Metal Company Ltd, Kathmandu, under an Indo-Nepal venture, for preparing zinc concentrate and extraction of the metal from hand-picked lead-zinc ore sample from the Ganesh Himal deposit in Nepal. In view of the surface oxidation problems of galena in the sample owing to long exposure to environment, a modified process involving gravity-cum-froth flotation route was adopted for production of zinc concentrate. Leaching studies carried out on the zinc concentrate led to more than 80% recovery of zinc and sulphur. A portion of zinc was found to be locked in wurtzite/pyrite phase. Leach solution was purified to the desired level of impurities for electrowinning.

Recovery of Nickel, Copper and Cobalt from Complex Indian Oxide Mineral Deposits: Being pursued in collaboration with the University of Leeds, UK, this project aims at development of a process based on carbothermic reduction with gypsum as flux for the extraction of nickel from laterite and to develop the carbonyl process for refining of nickel. Pelletization studies were carried out with lateritic nickel ore along with gypsum and non-coking coal in various molar proportions to get pellets with good physical properties. Various binders were tried. Effect of precalcination of nickel ore on pellet property was studied. X-ray, thermal and particle size analysis of pellet feed were conducted.

Fundamental Investigation on Advanced Ferrous Alloys. The overall activities in India, of this three-year Indo-US programme, are being coordinated by NML. The other participating organizations in this programme from India are: IIT, Kharagpur; IIT, Chennai: BHU, Varanasi; University of Roorkee, Roorkee; R.E. College, Rourkela; B.E. College, Howrah; R&D Centre for Iron & Steel, Ranchi; and Tata Steel, Jamshedpur. Naval Research Laboratory, Washington DC and Naval Surface Warfare Centre, Maryland, are the US counterparts.

Performance Indicators : 1995-96

R&D Projects	
Collaborative	
Ongoing	: 15 (including three international collaborations)
Completed	: 2
Thrust Area	
Ongoing	: 2
Sponsored	
Ongoing	: 14
Completed	: 21
Grant-in-aid	
Ongoing	: 13
Completed	: 2
Consultancy	
Ongoing	: 10
Completed	: 17
Exploratory	
Ongoing	: 32
Completed	: 27
Technical Services	
Ongoing	: 5
Completed	: 1
Technology Development/ Utilization	
Developed	: 6
Demonstrated	: 4
Transferred	: 2
Commercial production	: 1
Papers	
Published	: 119
Presented	: 113
Patents Filed	: 4

***Extra Budgetary Resources* (EBR)** -- Rs 21.074 million (Expected in 1996-97 - Rs 29.2 million i.e. 25% of the total budget)

With an expected funding of about Rs 13.7 million, this project aims at understanding the transformation characteristics of precipitation strengthened HSLA steel having yield strength of 100 Ksi so that optimum combination of thermo-mechanical processing parameters could be suggested. The programme would cover the following eight aspects: Transformation during quenching and ageing of HSLA and ULCB steels; Influence of thermomechanical processing and austenite grain-size on the transformation, microstructure and properties of HSLA and ULCB steels; Solubility relations in HSLA steels; Transformation of very coarse grained austenite and the resulting mechanical properties (changed to weldability of HSLA & ULCB steels); Corrosion characteristics of advanced ferrous alloys; Evaluation of final properties; Fatigue and fracture properties of HSLA and ULCB steels; Evaluation of final properties: Formability properties of HSLA 100 and other high-strength steels; and Evaluation of microstructure and properties in HSLA forgings.

A review meeting was organized during March 1996 in which a team of scientists from Naval Research Laboratory and Naval Surface Warfare Centre, USA, participated.

Thrust Area Projects

Considerable progress was made in the two Thrust Area Projects, namely Component Integrity Evaluation Programme (CIEP) and Processing of Polymetallic Sea Nodules for Recovery of Valuable Metals.

Component Integrity Evaluation Programme: The laboratory has developed facilities and expertise of international standard in the area of remaining life prediction and failure analysis. The first phase of CIEP, initiated in April 1993 under the financial support from SAIL, IOC, BPCL, AEC, Tata Steel and soft loan from World Bank, was successfully completed in 1995. Under the second phase of CIEP, services are to be provided to each sponsor in his required specific areas. In addition, a limited number of generic projects are to be taken up. The main emphasis would be on the development of non-destructive means of evaluating accumulated damage and microstructural/property changes in service exposed material.

Processing of Polymetallic Sea Nodules for Recovery of Valuable Metals: Copper, nickel and cobalt worth Rs 15000 million are imported annually. Due to limited land based resources, it is extremely difficult to cope up with the future demands of these metals. The Central Indian Ocean basin has high potential reserves of these metals. NML has developed a process, which consists of reduction roast, ammonia leaching, solvent extraction and electrowinning (RR-AL-SX-EW), to recover these metals from polymetallic nodules procured from sea. The project is funded by the Department of Ocean Development (DOD) who would decide on the choice of technology for scale up from 100 kg nodules per day to a level of 2 tonnes per day, and subsequently, the semicommercial demonstration plant to extract Cu, Ni, Co and Mn from the sea nodules. Based on the bench-scale data (1 kg batch), the process was scaled up to a level of 100 kg nodules per day. The overall recovery of copper and nickel metals is 85% and that of cobalt 50% in five campaigns on 100 kg per day scale.

Sponsored Projects

Development of Torpedo Ladle Car Bricks: Studies were taken up for M/s ACC, Katni, with the objective to produce dense high-strength alumina-SiC-C bricks for lining impact-prone area of torpedo ladle cars. The high temperature properties of the bricks and their microstructural aspects were studied, and the final report has been sent to the sponsor.

Service Assessment for High Temperature Components Operating in the Creep Range: The project aims at identification and quantification of accumulated creep damage and estimation of the remaining life of old thermal power plants and oil refineries. A systematic and comprehensive study on popular grades of steel has been initiated. A new method based on threshold stress concept has been proposed. The programme has successfully completed its first phase and entered the second phase of its operation with the participation of five user agencies and World Bank.

Environmental Pollution from Medium and Small Metal Processing Metallurgical Industries: Investigations carried out by NML have shown that pollution created by various metallurgical industries, especially by coke fired cupolas in the cast iron foundries, is exceedingly high. The average suspended particulate matter (SPM) level in the exhaust gases of these cast iron foundries is about 1500 mg/Nm^3 which is ten times more than the permissible limit. NML has shown that SPM level from cupola exit gases can be brought down below 150 mg/Nm^3, which is the permissible limit set by Central Pollution Control Board (CPCB), Delhi. The work was funded by the latter.

Development of a Pollution Control System for Indian Foundries: The Indian Foundry Association (IFA), Calcutta, sponsored a project for control of foundry pollution. The completed report has been already handed over to IFA and a demonstration plant designed by the laboratory is being set up at Shri Uma Foundries, Howrah.

Use of Grinding Dust from Steel Plant: The Alloy Steel Plant, Durgapur, sponsored a project to explore the possibility of utilization of non-stainless steel grinding dust generated during the grinding operation of blooms, billets and slabs. The iron powder so produced has 99% purity and can be utilized for making powder metallurgical components used in various industries. The alloy steel can be directly used for the manufacture of parts requiring high strength and wear resistance.

Development of Flow-sheet using Gravity and Magnetic Separators for Quality Production of Bauxite for Refractory Purpose: The total bauxite reserves of India are apparently high. However, most of them are not suitable for refractory use owing to impurities. Beneficiated bauxite conforming to the refractory specification has got tremendous industrial relevance. Beneficiation studies were carried out on bauxite sample received from M/s INDAL, Calcutta (Durgmanwadi Mines, Maharashtra). Attempts were made to reduce Fe_2O_3 and TiO_2 contents from 3.5% and 5.2% to the level of 1.5-1.7% and 1.5-2.0% in the concentrate respectively. The bench scale investigations are quite encouraging, and in order to develop a technological flowsheet, a fullfledged pilot scale trial has been recommended.

Development of Indigenous Flotation Column for Industrial Applications: A semi-commercial column of 0.5 m dia. with a capacity to treat 2-4 tonnes of ores per hour has been designed and developed at NML. The column has complete instrumentation required for level and wash water control, automatic sampling, etc. Also the NML's Madras Centre has designed and developed a special sparger for use with the 0.5 m dia. column. The latter has been tested at BGML, for the beneficiation of gold ores and the spargers have given excellent services. The NML Madras Centre entered into an agreement with M/s Gujarat Mineral Development Corporation at a fee of Rs 1.5 million for 'Commercial Development of Column Flotation Technology'.

Recently, NML Madras Centre, rendered technical consultancy services to M/s Larsen & Toubro Ltd, Calcutta for 'Improving the Grade of Sivaganga Graphite Concentrates'. The company with its original set up could produce only 89 to 90% fixed carbon (FC) grade graphite concentrate. NML suggested additional ball mill for grinding and bank of flotation cells for incorporation in the cleaner circuit. M/s Larsen & Toubro have since implemented the suggestions and plant is producing 92%+ FC grade graphite concentrate.

Pilot Plant Studies on the Beneficiation of Gold Ores by Column Flotation: Amenability of column for the beneficiation of gold ores of Nandydroog Mines of M/s BGML was initially established utilizing NML-designed 75 mm dia. column with excellent metallurgical results. Encouraged by these results, BGML sponsored a project to NML on the pilot plant trials utilizing 0.5m dia column designed and developed by the laboratory. This confirmed the results achieved on 75 mm dia. column and infact, gave better results. The laboratory showed the benefits of adoption of column flotation to M/s BGML for their operations.

Pilot Flotation Column Studies for the Beneficiation of Ambaji Multimetal Ore: In this project the role of NML was to support GMDC on all technical matters like selection, erection and commissioning of pilot plant, besides assisting in planning and execution of test runs/experiments necessary for the successful completion of the project. M/s GMDC procured a pilot size flotation column of 0.3 m dia. and 10m height with external bubble generators from M/s BRGM, France. Assistance was rendered in erection and commissioning of the pilot column at Ambaji Project and beneficiation studies were carried out on their multimetal ore. The results were compiled and the report submitted to M/s GMDC.

Direct/Continuous Steel Making: At the instance of Technology Information Forecasting (TIFAC), DST, New Delhi, a status report on Direct/Continuous Steelmaking has been prepared. The report encompasses information and various developments on the direct steelmaking in India.

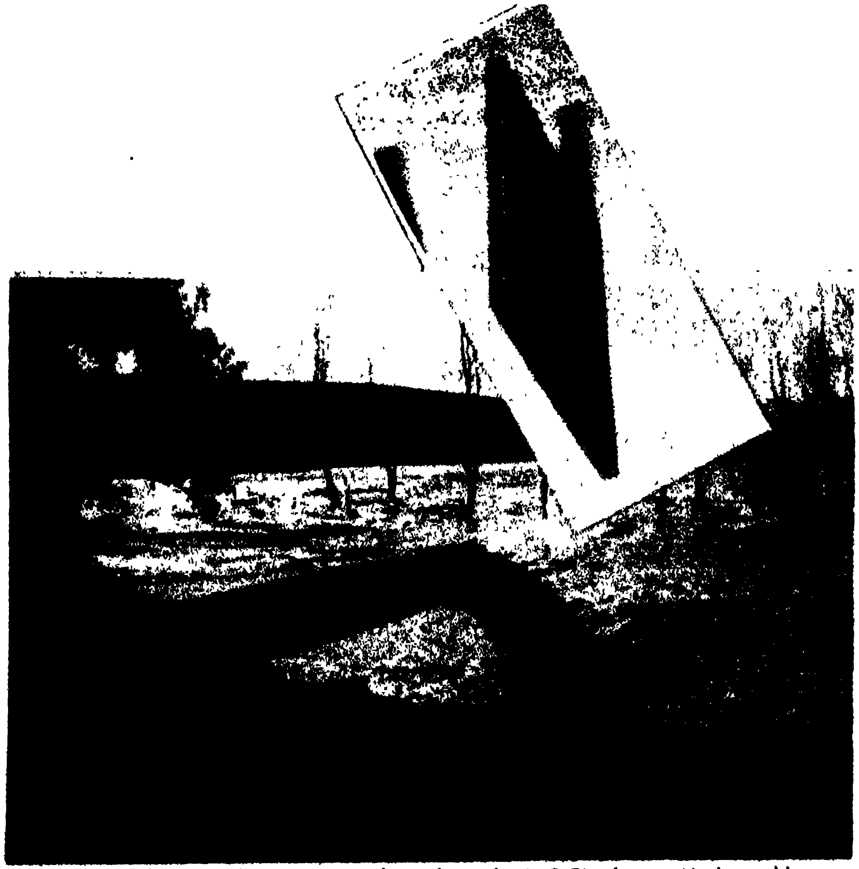
MoUs signed

Encouraged by laboratory's exploratory results, M/s Tamilnadu Mineral Ltd, Chennai, has signed an MoU with NML for preparation of a detailed project report for setting up of a modern sand processing plant. Similarly, several other MoUs were signed. To name a few -- Assistance for setting up of a Testing and Evaluation (Analytical & Mechanical) Laboratory, with M/s National Testing & Research Laboratory, Calcutta; Life assessment of ageing power plant components, with M/s RPG-PR Power Engineering Pvt. Ltd, Calcutta; Improving strand productivity of Visakhapatnam plant with Hindustan Zinc Ltd; Making Ferro-titanium with M/s Easier Engg. & Foundry Ltd, Jamshedpur; and Nickel-free SS and special alloys, with DMRL and VSSC.

Other Major Projets

M/s Kudremukh Iron Ore Company Ltd sponsored two projects namely: Ceramic floor/wall tiles from iron ore slimes and synthesis of Mn-Zn and Ni-Zn ferrites using beneficiated iron ore fines of KIOCl. Both these projects are nearing completion, and significant results have been achieved.

A collaborative project with Tata Steel for the production of 'Nano-crystalline Ultra-pure Alumina Powder' was in progress. This powder has been synthesized through Sol-Gel route, an economically viable process. Alumina powder with 99.95% purity and > 0.5 µ has been produced at the rate of 2.5 kg/day. The powder has been evaluated by outside parties.



Tile made using the iron ore tailings from the KIOCL plant at Kudremukh

A project on deoxidation of low carbon micro-alloyed steel has been taken up in collaboration with IIT, Kharagpur. Extra-low carbon micro-alloyed steels and interstitial-free steels are ideally suited for automotive industry. Increasing demands for thinner sheet steels require higher cleanliness in steel, because surface defects caused by non-metallic inclusions become more serious with decreasing thickness of the steel sheet. Extra-low carbon (C 0.01-0.15%) micro-alloyed steel has been successfully produced in an induction furnace using M.S. Scrap and DRI as charge materials. The cast ingot of steel was rolled into a sheet of 0.2 mm thickness. The rolled sheet having excellent surface quality and superior formability is extremely suitable for automotive applications.

A collaborative project on development of water treatment chemicals has been taken up with Tata Steel. A rig has been installed at NML for evaluation of recirculating water.

NML undertook another collaborative project with Tata Steel to evaluate organic, inorganic and metallic coatings under laboratory conditions, and industrial and marine atmospheres. These coated panels were being evaluated at MCRS, Digha and at NML, Jamshedpur as per ASTM standards.

Extra Budgetary Resources (EBR) from users yielded Rs 21.07 million during the year, and a major portion of the fund has been utilized for creating more facilities and enhancing more capabilities for the laboratory. One hundred and nineteen papers were published and 113 were presented. Four patents were filed□

IICT avails World Bank Soft Loan for Technological Reorientation and Capability Strengthening

THE Indian Institute of Chemical Technology (IICT), Hyderabad, took several initiatives during the last five decades to provide technologies and services to the various sectors of chemical industry in India. More than 175 technologies have been successfully commercialized by 200 industrial units in the chemical sector. With the globalization of Indian economy, IICT is reorienting its policies and business strategies to meet the present and future challenges at the global and national levels. The institute's management has identified the need for enhanced capability building for undertaking innovative research for the development of eco-compatible chemical products and processes. Modernization of scale up, quality control and design facilities in critical areas has accordingly become a necessity. After a careful review of its current strengths and weaknesses *vis-a-vis* the opportunities and threats, the institute approached the World Bank for providing financial support to strengthen its facilities and capabilities in the new molecules and products research, reaction engineering and scale up of eco-compatible processes, and design engineering of industrial wastewater treatment and hazardous waste disposal. Research areas/facilities mentioned in Table-2 will receive World Bank support to the extent of Rs 140 million during 1997-98.

The World Bank programme will be implemented to commercialize new facilities by the end of December 1997. ❑

Table - 2

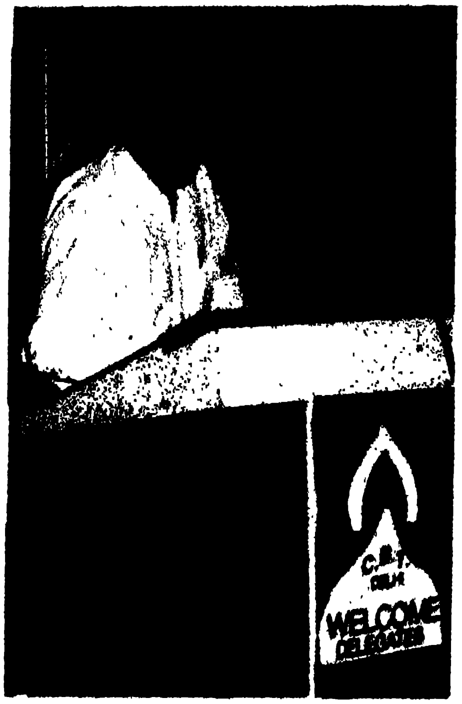
Research Areas	Centralized Facilities
• Natural Product Chemistry	• Molecular Modelling and Combinatorial Chemistry
• Industrial Organic Chemistry	• Pharmacology
• Drugs/Pharmaceuticals	• Toxicology
• Coal/Gas Based Chemicals	• Biotransformation
• Catalysis	• Reaction Engineering/ Process Scale up
• Organic Coatings and Polymers	• Pilot Plants II and IV
• Lipid Science and Technology	• PROSAC
• Bioscience/Technology	
• Analytical Chemical Sciences	
• Chemical Engineering Process	
• Design and Development	
• Plant Engineering Sciences	

Colloquium on Allergy and Immunology

A Colloquium on Allergy and Immunology was organized in the Centre for Biochemical Technology (CBT), Delhi on 2 June 1997 in honour of Dr S.V. Gangal, outgoing Director, CBT, on his superannuation. The seminar was inaugurated by Dr A.P. Joshi, former Head of CBT, who was the chief guest on this occasion. Dr Joshi and Dr P. Usha Sarma, Officiating Director, CBT, highlighted the work carried out by Dr Gangal during the last two and half decades in the area of allergy and immunology.

Dr Gangal gave a special lecture on 'Immunomodulation by allergen entrapped liposomes and their application in safe and effective immunotherapy of allergic disorders'.

Lectures on 'An overview on allergy research in India' by Dr M.K.



Dr A.P. Joshi addressing the participants during the Colloquium on Allergy and Immunology

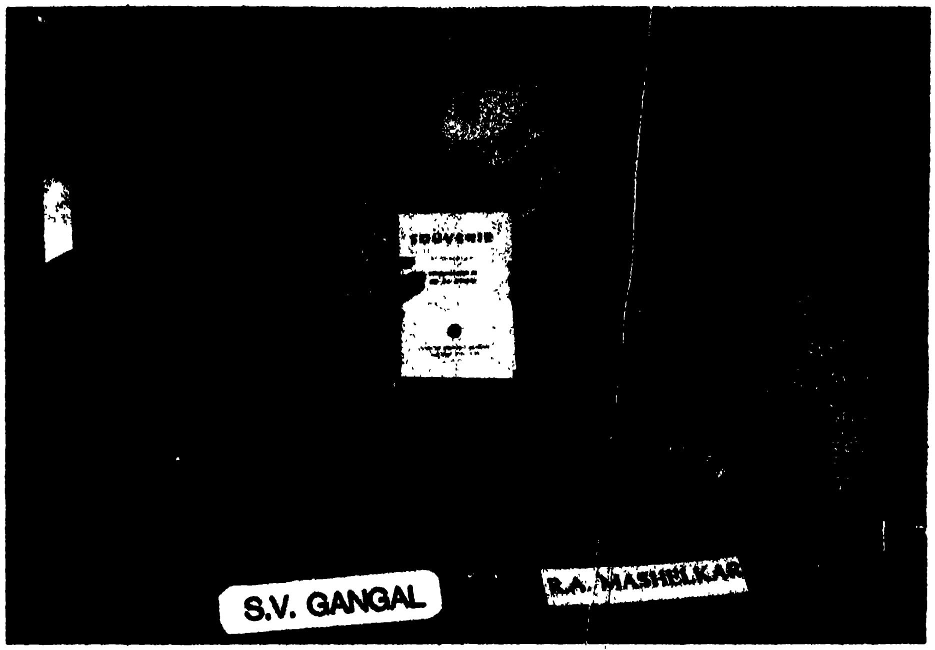
Aggarwal, VPCI, 'Facts about immunotherapy' by Dr S.N. Gaur, VPCI, 'Clinical aspects of allergy' by Dr Ashok Shah and 'Quality control of allergens' by Dr Susheela Sridhara were also delivered during the colloquium.

Dr A.B. Singh, Scientist, CBT, proposed a vote of thanks.

Felicitations to Dr S.V. Gangal

A function was also organized to felicitate Dr S.V. Gangal. Dr R.A. Mashelkar, Director General of CSIR, was the Chief Guest and Dr V.C. Vora, Chairman of the CBT RC chaired the session. Dr R.A. Mashelkar and Dr V.C. Vora appreciated the work done by Dr Gangal, particularly in the field of Allergy and Immunology. Dr Mashelkar also presented a memento to Dr Gangal.

Dr Gangal has rendered two and half decades of service to CBT. He became its Director in November 1992 after the retirement of Dr A.P. Joshi. ❑



Dr R.A. Mashelkar, Director General, CSIR, releasing a souvenir on the occassion of felicitations to Dr S.V. Gangal

Seen during the National Symposium on Mycoses *(from left)* are: Prof. Asis Datta, Dr Manju Sharma, Dr H.S. Randhawa and Dr P. Usha Sarma

National Symposium on Mycoses

A National Symposium on Mycoses was held from 5 to 7 May 1997 at the Centre for Biochemical Technology (CBT), Delhi. The Symposium included six sessions: Clinical and Laboratory Diagnostics, Molecular Basis for Fungal Diseases, Immunopathogenesis, Biochemical and Diagnostic Aspects, Novel Drug Delivery Systems and Therapeutics and General Aspects of Fungi. About 150 scientists from India and a few from abroad participated in the deliberations of the symposium which was first of its kind as it reflected multidisciplinary approaches towards development of diagnostic and therapeutic measures for an important field of infectious diseases, i.e. Mycoses. It stressed the need for development of specific and sensitive immuno and molecular diagnostics for important fungal diseases such as *Aspergillus candiasis, A. mucoriasis, A. cryptococeasis* and *A. alternariasis.* Also emphasized was the necessity to study the mechanism of pathogenesis of these invasive fungal diseases as they are highly complex in nature with respect to molecular nature of the pathogen as well as varied host immuno responses. The recombinant DNA technology can be used to characterize immunodominant antigens and the epitopes. This would facilitate detailed examination of possible protection by these antigens. ❑

WORKSHOP

Fourth NAL-CAE Workshop

THE protocol for scientific cooperation between the National Aerospace Laboratories (NAL), Bangalore and Chinese Aeronautical Establishment (CAE), China, signed in August 1994, has resulted in four very useful and well-attended workshops and a significant amount of collaborative work, notably in the areas of aerodynamics, propulsion, composites, fatigue/fracture and advanced gas turbine technologies.

The fourth workshop in the NAL-CAE series of workshops, titled, Advanced Gas Turbine Technologies-I, was held at NAL during 10-12 June 1997. This workshop featured two keynote lectures, seven invited lectures and nearly 30 contributed papers in the areas of compressor and turbine aerodynamics, blade cooling, CFD in turbomachines, mechanical aspects and engine testing.

The Chinese team at the workshop was led by Prof. Chen Jun, Director of the Aeroengine Department of AVIC, and included eight other professors and engineers. The Chinese team also visited NAL's Composite Structures Lab, Structural Integrity Division and the Surface Engineering Unit. ❑

World Environment Day Celebrations at ITRC

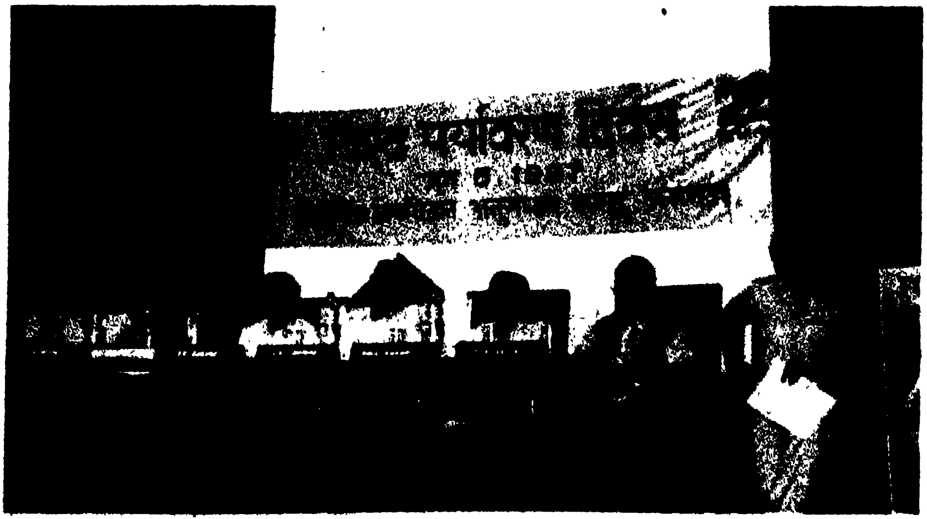
WORLD Environment Day was celebrated at the Industrial Toxicology Research Centre (ITRC), Lucknow, on 5 June 1997. Shri P.C. Sharma, IAS, Principal Secretary, Forest Department, U.P. Government, presided over the function. Shri Anis Ansari, IAS, Chairman and Commissioner and Director, Uttar Pradesh Development Systems Corporation Ltd; Prof. L.N. Mathur, Emeritus Professor of Law, Lucknow University; and Padmashri Ali Sardar Jafri were the invited speakers.

Dr P.K. Seth, Director, ITRC, in his welcome address, highlighted the significance of the Day, and described the ITRC's programmes particularly related to safeguard the water, air and noise, environment impact assessment and various collaborative research programmes with the State Government. He informed that the institute is undertaking the monitoring of the Gomti River, under a project sponsored by ODA, through the Ministry of Environment and Forest, and the Residues of Pesticides in a project sponsored by ICMR. He said that ITRC through its technology-driven research is committed to safeguarding the environment and help the regulatory agencies by providing the necessary data for regulation of the chemicals.

He said that the function was a step in the direction of 'Development without Destruction', and identification of the joint efforts needed to address the problems of the state of Uttar Pradesh.

On this occasion a report on 'Ambient Air Quality and Noise Pollution in Lucknow: A Random Survey', prepared by ITRC, was released by Padmashri Ali Sardar Jafri.

Shri P.C. Sharma, while delivering his presidential address said that forests are the life line of human beings as they provide food, shelter and medicines. Many of the plant



Seen on the dais during the World Environment Day Celebrations at ITRC *(from right)* are: Dr P.K. Seth, Director, ITRC; Shri Anis Ansari, IAS, Chairman and Commissioner and Director, Uttar Pradesh Development Systems Corporation Ltd; Prof. L.N. Mathur, Emeritus Professor of Law, Lucknow University; Shri P.C. Sharma, IAS, Principal Secretary, Forest Department, U.P.; Padmashri Ali Sardar Jafri; and Dr Shashi Khandelwal, Assistant Director, ITRC species used in agriculture for the production of food, vegetables and fats have their origin in forests. The disappearance of the home of natural resources, i.e. forests, will lead to disruption in human welfare activities. Therefore, one single factor that can help to improve our environment and thus the sustenance of mankind lies in tree plantation and conservation of existing forests.

Shri Anis Ansari delivered a lecture on 'Industrial Development and Environment', in which he emphasized that although industrialization is inevitable, yet it is adversely affecting our environment. Today, places of industrial concentration are under constant vigilance of the Pollution Control Boards and the courts. A balance has to be maintained between industrialization and environment in the larger interest of mankind, wildlife and nature. He also referred to the constitutional provisions which have imposed duty on the state and every citizen of India to protect and improve the natural environment. Industrial progress and environmental conservation have to be complementary to each other and not opposite to each other.

Prof. L.N. Mathur spoke on 'Environmental Planning and Enforcement Action'. He stated that modern civilization is facing ecological crisis of its own creation. He cited a case of United States President asking a Red Indian in 1854 to sell his land to the government but the owner refusing to sell the same wondering how could any one buy or sell the sky, the warmth of the land, the freshness of air and the sparkle of nature.

Prof. Mathur also mentioned about the provisions in Art. 21 and 51-A(g) in the Indian Constitution dealing with the protection of Environment. He highlighted the recent laws for the preservation of environment: the Water (Prevention and Control of Pollution) Act. 1974, the Air (Prevention and Control of Pollution) Act. 1980 and the most recent Environmental Protection Act. 1986 where provisions exist for dealing with the problems of prevention and control of Pollution of Air, Water, Noise, Radiation, Hazardous Waste, Pesticides, Wildlife, Smoke, etc. But the laws themselves do not and cannot ensure clean environment unless effective remedial measures are available, he stressed.

Padmashri Ali Sardar Jafri, a renowned Urdu poet and literary person said that the environment is being adversely affected because of the ever increasing greed of the people to have more and more without any consideration for the limited natural resources. He reminisced the beautiful gardens of various cities of India which are now full of skyscrapers, smoke, dirt, and waste materials. He recalled his memories of Lucknow as a Garden City, when he was a student at Lucknow University. He said that Delhi, once a beautiful city, is today one of the most polluted cities of the world. Expressing his concern he added that it appears that now people have lost love for their country.

Dr Shashi Khandelwal, Convener of the Programme, proposed a vote of thanks. ❑

TRAINING PROGRAMMES

Entrepreneurship Development Course on Improved Cook-stoves

THE Central Glass & Ceramic Research Institute's Khurja Centre is a pioneer Centre in the design and development of ceramic-lined metal-clad cook-stoves. The centre was assigned by the Ministry of Non-conventional Energy Sources, New Delhi, three En-

Participants of the Entrepreneurship Development Course on Improved Cook-stoves trepreneurship Development Courses on manufacturing of improved cook-stoves, during 1996-97. One of these courses was conducted from 26 March to 4 April 1997. It was attended by 10 participants from Gonda, Jaunpur and Bulandshahr.

The course comprised theoretical lectures with practical demonstrations on importance of improved cook-stoves, raw materials for ceramic liners, body making, different techniques of liners making, firing techniques for ceramic liners, metal clading and testing methods of cook-stoves. The main emphasis was on manufacturing *Shambhu* and *Cera-Agro* stoves which had been designed and developed by the Khurja Centre. The model *Shambhu* has been widely accepted by rural beneficiaries of Uttar Pradesh and about 210,000 *chulhas* have been manufactured by different entrepreneurs of the state and distributed in rural areas. ❑

Entrepreneurship Development Programme on Ceramics

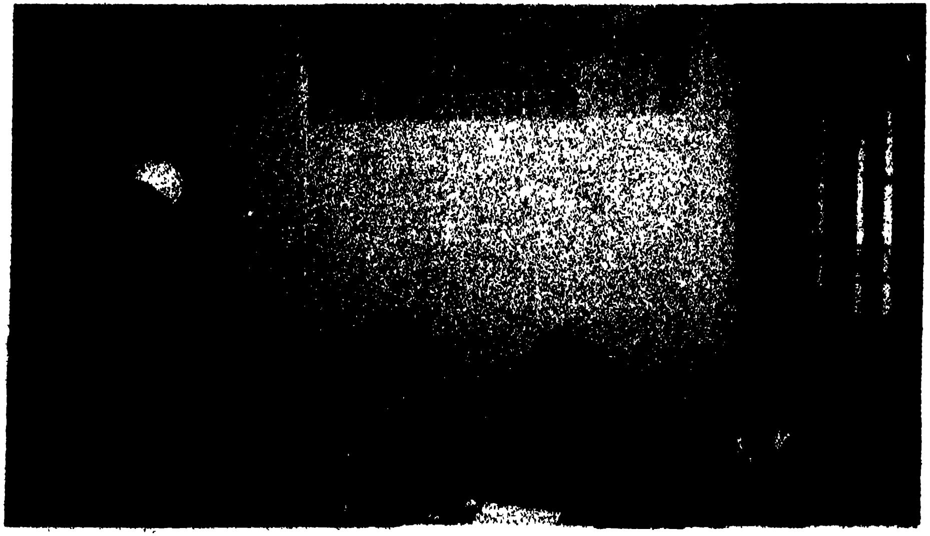
AN Entrepreneurship Development Programme (EDP) on Ceramics was organized by the Central Glass & Ceramic Research Institute's Khurja Centre from 17 February to 22 March 1997 at Khurja, under the sponsorship of Department of Science & Technology, New Delhi. Nineteen entrepreneurs selected from different parts of Uttar Pradesh and New Delhi attended the programme which was inaugurated by Shri A.K. Sharma, Sub-Divisional Magistrate, Khurja.

The six-week programme comprised twenty-five lectures and practical demonstrations covering the following aspects: sources, selection & suitability of ceramic raw-materials and their properties, formulation of different ceramic bodies, processing, fabrication techniques, drying and making of plaster moulds, ceramic glazes & colours, different types of kilns and their firing operations, decoration of ceramic wares, quality control, etc. The lectures were delivered by experts from the Khurja Centre; College of Ceramic Engineering, Varanasi; IIT, Mumbai; Design Centre, Lucknow, etc. Practical demonstration on standard ceramic practices were also conducted covering terracotta, stoneware & steatite porcelain, etc. Visits to six industrial units were also arranged.

In addition, financial assistance available from banks and other financial institution for setting up of new ceramic units in U.P. were discussed by experts from State Bank of India, Punjab National Bank, The National Small Industries Corporation, Uttar Pradesh Industrial Corporation, Uttar Pradesh Financial Corporation, etc. Societies Act and Labour Act were also discussed by the experts from U.P. Corporative Societies and U.P. Industrial Corporation.

Opportunities in ceramics and technical assistance available were highlighted by the faculty members drawn from the Khurja Centre, Small Industries Service Institute, National Small Industries Corporation, Khadi & Village Industries Commission, Uttar Pradesh Industrial & Technical Consultancy Organisation as well as from the existing ceramic industry in Khurja. Topics like financial management including cost of production, assessment of working capital, outline of financial accounting, breakeven analysis, etc. and market research and market survey were discussed by the experts from financial institutions and UPICO, respectively.

At the valedictory session of the programme, Shri A.K. Gupta, Dy. Scientist-in-charge welcomed the Chief Guest Shri M.L. Khurana, General Manager, District Industries Centre, Bulandshahr and other distinguished guests from industry and state government. The Chief Guest distributed certificates to the trainees. ❑



Mr Gurudeep Singh, Jt. Director, Principal Ceramic Polytechnic, Khurja, addressing the participants during inauguration function of E.D.P. on Ceramics

ANNOUNCEMENTS

Refresher Courses/Training Programmes at CECRI

THE Central Electrochemical Research Institute (CECRI), Karaikudi, will be conducting the following refresher courses/training programmes during 1997-98.

S.No	Name of the courses	Duration	Course Fee
I. Corrosion Science & Engineering			
1.	Corrosion Science & Engineering (General)	18-23 August 1997	Rs 2000
2.	Corrosion of Steel in Concrete	25-30 August 1997	Rs 2000
3.	Cathodic Protection Systems, Devices and Anodic Protection	8-13 September 1997	Rs 2000
4.	Corrosion Control in Boilers and Heat Exchangers	24-29 November 1997	Rs 2000
5.	Corrosion in Oil and Gas Production	29 September-4 October 1997	Rs 2000
6.	Corrosion Control in Petroleum Refineries	13-18 October 1997	Rs 2000
7.	Corrosion Control in Fertilizer Industries	20-25 October 1997	Rs 2000
8.	Oil Pipeline Corrosion and Its Control	3-8 November 1997	Rs 2000
9.	Paints for Corrosion Protection	1-6 December 1997	Rs 2000
II. Inorganic Electrochemicals			
1.	Water Treatment Technology	3-7 November 1997	Rs 1750
2.	Pollution Control & Monitoring	10-14 November 1997	Rs 1750
3.	Instrumental Methods of Analysis	17-21 November 1997	Rs 1750
4.	Electrochemical Process Engineering for Environmental Protection	24-28 November 1997	Rs 1750
5.	Information Technology (IT) for Libraries	17-21 November 1997	Rs 750
6.	Micro CDS/ISIS: Library and Information Retrieval Applications	24-28 November 1997	Rs 750
7.	Chlor-Alkali Technology	16-20 March 1998	Rs 1750
III. Batteries			
1.	Storage Batteries	1-5 December 1997	Rs 1750
2.	*Lead Acid Battery*: Raw materials and Grid Technology	8-12 December 1997	Rs 2500
3.	*Lead Acid Battery*: Assembly, Testing, Care and Maintenance	15-19 December 1997	Rs 2500
IV. Industrial Metal Finishing			
1.	Industrial Practice of Plating and Finishing	19-24 January 1998	Rs 2000
2.	Anodising of Aluminium and Its Alloys	27-31 January 1998	Rs 1750
3.	Electroplating of Copper, Nickel, and Chromium	2-7 February 1998	Rs 2000
4.	Cadmium, Zinc and Tin Plating Shop Problems and Remedies	9-14 February 1998	Rs 2000
5.	Plating of Precious Metals	16-21 February 1998	Rs 2000
6.	Maintenance of Electroplating Baths	23-28 February 1998	Rs 2000
7.	Inspection and Testing of Electrodeposited, Electroless and Anodic Coatings	2-7 March 1998	Rs 2000
8.	Pollution Control in Plating and Metal Finishing Industries	9-13 March 1998	Rs 1750

For further details, please write to: Director, CECRI, Karaikudi 630 006. Phone: 04565-23213, 22368; Fax: 91-4565-22088, 23213; Telex: 0443-211 ECRI IN or 0443-222 ECRI IN; Grams: CECRI ☐

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit

Annual Subscription : Rs. 60
Editors : Dr B.C. Kashyap and Dr C.S. Gupta Editorial Assistant : Neelima Handoo Production : Kaushal Kishore Single Copy : Rs. 3.00
Phone : 5786301 Gram : PUBLIFORM Telex : 031-77271 E-mail: niscom@sirnetd.ernet.in. Fax : 5787062
RN 4512/57

ISSN 0409-7467

VOL 47 NO 15 15 AUGUST 1997

CSIR NEWS

A view of the one-tonne per day demonstration plant using membrane cell for caustic soda production set up at the Central Electrochemical Research Institute, Karaikudi, with financial assistance from TIFAC of DST (p. 210)

IIP signs MoU with UOP, USA

THE Indian Institute of Petroleum (IIP), Dehra Dun, has signed a Memorandum of Understanding (MoU) with Universal Oil Products I-A (UOP-I-A), an affiliate of UOP, Des Plaines, Illinois, USA, at a function held in Dehra Dun on 14 July 1997, for joint research and technology development. The agreement was signed by Dr Stanley A. Gembicki, Chief Technology Officer of UOP and by Dr T.S.R. Prasada Rao, Director, IIP.

IIP is making extensive efforts for the past few years for globalization of its various technologies. Although IIP has agreements with several other international companies but to have alliance with UOP, which is a world leader in the area for the last 80 years and has world wide operations, the present agreement assumes a great significance. UOP has over 10,000 patents, 70 licensed processes, more than 6,000 process units licensed all over the world and has a staff strength of 3700 persons..

Speaking at the function, Dr T.S.R. Prasada Rao said that it was a historical day in the history of IIP where the efforts to have global alliances and globalization of IIP's technologies have crystallized into fruitful results. Few years back the Indian scientists were concentrating on import substitution and indigenous developments but now the aim is to commercialize the innovative ideas and technologies.

Salient features of the agreement include setting up of targets for various projects and reviewing of progress in four defined phases with well defined milestones. Patents arising out of this joint venture are to be filed jointly.

Dr Mat Malladi, Head of Joint Ventures Formation at UOP, hoped that the agreement would lead to a self sustaining relationship between UOP and IIP.

Dr Stanley A. Gembicki of UOP expressed his excitement about the success of UOP-IIP collaboration. He pointed out that the ideas are in abundance and lot of money could be made by transferring knowledge and ideas.

Dr M.P. Saxena, a senior scientist of IIP, proposed a vote of thanks. The proceedings were convened by Dr K.S. Jauhri, Area Leader, Industrial Liaison, IIP. ❑

Dr T.S.R. Prasada Rao, Director, IIP, and Dr Stanley A. Gembicki, Chief Technology Officer of UOP, signing the MoU for joint Research & Technology Development

Membrane Cell for Caustic Soda commissioned

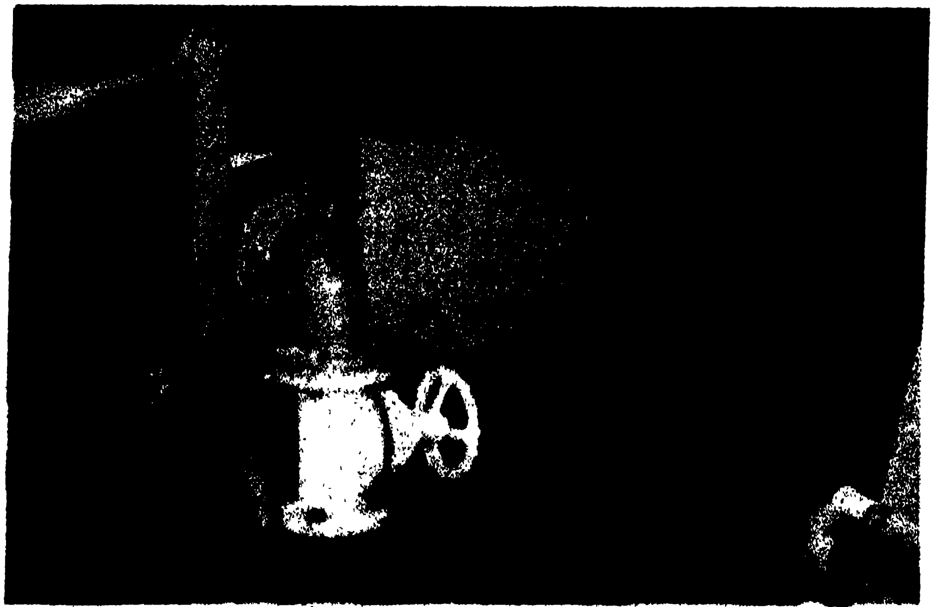
CAUSTIC soda and chlorine are important industrial chemicals. They are produced by the electrolysis of aqueous sodium chloride solution. The mercury cell process is a well established technology for the production of concentrated (45-50 wt%) and chloride-free caustic which is directly obtainable from the cell. In this process, sodium is discharged at the mercury cathode, forming an amalgam with it, which is decomposed to get caustic soda. Use of mercury in this process creates serious pollution problems. Mercury losses amount to 0.2 kg per tonne of caustic produced. Of the annual production of 1.22 million tonnes of caustic, 0.78 million tonnes are produced based on mercury cell technology, causing serious mercury pollution.

To combat the hazardous mercury pollution, plants using mercury cell process are being converted to non-mercury process. The alternative technology, diaphragm cell process does not involve mercury but it produces a weak caustic liquor of concentration 10-12%, containing up to 15% sodium chloride which has to be further processed to get concentrated caustic, consuming good amount of energy. Still the caustic produced contains 1% salt, limiting its usage. This process involves the carcenogenic asbestos diaphragm and is hence environmentally unacceptable.

Worldwide trend is to develop ion exchange membrane cells giving caustic liquor of concentration and purity comparable to that obtainable from membrane cell process. This technology is environment friendly and energy conserving. CECRI has developed this technology with suitable catalytic anode, catalytic cathode, indigenous cell components and secondary brine purification system. The only imported component in these electrolyzers is the Nafion cation exchange membrane. Electrolyzers of both monopolar and bipolar type have been operated with a current rating of 6kA and 3kA respectively. The results obtained in a typical bipolar cell are given below:

Current density	3 kA/m^2
Current rating	3 kA
Cell operating temperature	85 °C
Current efficiency	95%
Caustic concentration	32-34 wt%
Cell voltage	3.00-3.10 V

The performance of the cell is at par with international standards. Data are available for the basic design. Based on this, a one tonne per day plant has been set up at CECRI with the financial assistance from TIFAC of DST, for demonstration and further scale up. First trial run of the demonstration plant took place during the visit of TIFAC monitoring committee on 2 May 1997. The performance of the demonstration plant was quite satisfactory. The advantages of the technology are reduction in investment cost, availability of anode and cathode coatings, continuous collaboration for updating technology and efficient operation of the plant. ☐



3 kA Rating bipolar membrane electrolyzer for NaOH - Cl_2 production

IICT Technologies Transferred/ Commercialized

Monocrotophos Plants

BASED on the process knowhow and detailed engineering designs provided by the Indian Institute of Chemical Technology (IICT), Hyderabad, three firms — Tantech Pesticides (Cuddalore), Pioneer Pesticides (Haryana) and India Pesticides Ltd (Lucknow) — have commissioned their commercial monocrotophos plants, each with a capacity of 600 TPA. The IICT team participated in the commissioning trials for smooth transfer of technology.

Castor Oil Complex

M/s Surana Oils and Derivatives India Ltd, Secunderabad, has successfully commissioned the BSS oil, HCO and 12-HSA plants of their castor oil complex near the Hyderabad city. The IICT team participated in the commissioning trials. The plant is designed to produce BSS oil, HCO, 12-HSA, DCO, DCO fatty acids and methyl 12-hydroxy stearate at a total production capacity of 50 TPD. The total project cost is Rs 100 million. The second castor oil complex is being set up by M/s Sunrise Oleo Chemicals Ltd, at Sadasivapet, near Hyderabad city.

Azithromycin Technology

M/s Kopran Ltd, Mumbai, have started commercial production of Azithromycin, a broad spectrum antibiotic, based on the technology developed by IICT.

Paper Board Production

M/s R.S.P. Cardboard Industry, B. Komarapalayam (Tamil Nadu), has recently commercialized the IICT technology in its plant.

Adhesive and Allied Technologies

Surgical tissue, insect trap and automatic labelling adhesive technologies have been successfully transferred to Concord Drugs Ltd and Nectar Laboratories (Hyderabad), Pheromone Chemicals (Bapatla) and Rao Industries (Bangalore), respectively. IICT has also transferred its technologies for acoustic tile (from rockwool fibres), indelible ink and herbal cosmetics to small scale industrial sector. ❑

R&D Flashes from CEERI

Travelling-Wave Tubes for Defence & Space Applications

THE Central Electronics Engineering Research Institute (CEERI), Pilani, had pioneered the development of a Travelling-Wave Tube (TWT) for satellite earth stations in the country during the eighties. In the nineties, CEERI has embarked upon highly challenging project on development of user specific helix and coupled-cavity TWTs for defence applications. The institute is poised to take a big leap by initiating a programme on development of satellite-borne TWTs for the INSAT programme of the Indian Space Research Organisation.

Development of Wideband Miniature Helix TWT for Phased Array Radar

The development of a Wideband Miniature Helix TWT for application of a ship-borne Phased Array Radar System has been taken up with a grant provided by the Defence Electronics Research Laboratory (DLRL), Hyderabad. Bharat Electronics, Bangalore, is also actively collaborating in this project. The development work has now reached the point of achieving the basic design goals. A prototype of the mini-TWT, which has been integrated at CEERI and tested recently at Bharat Electronics, achieved a saturated pulsed rf output power level of 40 W (minimum) over an octave bandwidth in the C-X-Ku band. At the mid-band this parameter has even surpassed the 60 W level. The saturated gain over the full bandwidth has been well above the desired level of 40 dB. Further work on fine tuning of the device and reproducibility for tube-to-tube matching is going on.

Development of C-Band, 70 kW (Pulsed) Coupled-Cavity TWT

A C-band, 70 kW (pulsed) Coupled-Cavity TWT (CC-TWT) for a specific radar system is being developed at CEERI under a research contract awarded by MTRDC, Bangalore. Bharat Electronics, Bangalore is also collaborating in this project. The first laboratory prototype of this CC-TWT has been fabricated to establish various technologies and assembly techniques. Work on fabrication of two more laboratory prototypes is going on. Some critical techniques such as fabrication of shadow control grid pair, ceramic loss buttons and kanthal coating of rf cavities have been developed. The high voltage power supply for this TWT is being indigenously developed at SAMEER, Mumbai, under a project contract from CEERI.

Electron Gun Assembly

A special purpose electron gun assembly has been designed, fabricated and supplied to Bhabha Atomic Research Centre (BARC), Mumbai. As per requirements of the accelerator and pulsed power division of BARC, the gun has been fabricated. A satisfactory report has been received from BARC. More such interactions are being expected in the near future with BARC.

Microprocessor for Telecommunication Applications

CEERI has designed a 16-bit microprocessor which is instruction-set compatible to Motorola's 68010 microprocessor. This design project was sponsored by the Department of Electronics, Government of India, through a grant-in-aid project.

The design has been carried out using VHDL hardware description language-based high-level synthesis approach. Using this approach, a Register Transfer Level (RTL) description of the design has been developed which can be synthesized to generate a logic gate level description for the selected silicon foundry using industry standard high-level synthesis tools and the gate- level library of the chosen silicon foundry. The gate level description of the design can then be automatically converted to silicon layout using industry standard CAD tools.

Thus the design is not tied to any single silicon foundry and can in fact be easily targeted to any chosen silicon foundry. The design was developed to meet the higher speed requirement of indigenous telecommunication industry for their digital switches based on the 68010 microprocessor.

The design effort involved was approximately twenty man years and has given CEERI the experience necessary to undertake more complex processor design projects in the future. ❑

Steel Arch Setting Device

THE Central Mining Research Institute (CMRI), Dhanbad, has developed a Steel Arch Setting Device which can set steel arches in underground mines quickly and easily.

The conventional process of setting steel arches is cumbersome as well as time-consuming. It requires deployment of a crew of about 12 to 14 persons to set a single arch and

Steel arch setting device developed by CMRI

New Projects taken up and Technologies transferred by NML

THE National Metallurgical Laboratory (NML), Jamshedpur, has been assigned the following new projects by external agencies:

- **Fabrication, procurement and supply of 3" dia lab, column flotation system (NMDC, Hyderabad)**
- **Development of magnetic sensor for material characterization (DST)**
- **Studies of updraft lead sintering for improving standard productivity (HZL)**
- **In-situ metallography on SS components in FCCU (Cochin Refineries)**
- **Trace analysis of tramp elements of pig iron (Sesa Industries, Goa)**
- **Acoustic emission studies of LPG Horton Sphere (Bharat Petroleum, Mumbai)**
- **Preparation of super alloys and SS (VSSC, Thiruvananthapuram)**
- **Failure analysis of LP turbine blade of unit 5 (Thermal Power Station, Kolaghat)**
- **Peritectic transformation in multi-component iron-based alloys during continuous casting (Tata Steel)**
- **Development of ceramic tiles from ferro-chrome and other industrial wastes (FACOR, Visakhapatnam)**
- **Wiredrawing of SS Rods (VSSC, Thiruvananthapuram)**
- **Studies on structural and mechanical aspects of nano- quasi-crystalline alloys (DST)**
- **Failure analysis of leaf spring (Jai Parabolic Springs Ltd., Chandigarh)**
- **Preparation of report on iron ore upgradation to reduce alumina and utilization of fines in sinter (TIFAC)**
- **Failure analysis of counter shaft of V-belt drive of centrifugal pump (NALCO)**

Technologies Transferred

- **Production of copper powder has been transferred to Jamshedpur Meta-Chem Industries.**
- **Production of ferro-vanadium from alumina sludge has been transferred to M/s Gyan Ferro Metals Ltd, Jamshedpur.**

MoUs Signed

Two MoUs were recently signed with (i) M/s Fusion Engineering Products, Jamshedpur and (ii) National Aluminium Co, Bhubaneswar in connection with projects and services. ❑

only two arches can be installed in a day. Whereas, using the CMRI-developed device, it is possible to install 12 to 14 arches in a day by two to three persons only. In this, one person operates the machine which lifts and sets the arch properly touching the roof in erect position within 10-15 minutes. This process eliminates the use of wooden cogs or additional supports generally required for setting arches by the conventional methods. The usage of wooden cogs or additional supports is somewhat unsafe also.

One added advantage of the CMRI method is that it can provide a setting load of 5 to 6 tonnes, which is not possible with the existing methods.

Moreover, the cost of the machine developed by CMRI is very low is easy to operate. Also, its maintenance and repairing cost is expected to be almost negligible. ❑

CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE, KARAIKUDI
R&D Highlights : 1995-96

THE R&D programmes of the Central Electrochemical Research Institute (CECRI), Karaikudi, fall under the following areas: corrosion science and engineering; batteries and fuel cells; electrochemicals; electrochemical materials science; electrodics and electrocatalysis; electrometallurgy; industrial metal finishing; and electrochemical electronics and instrumentation. The performance of the institute during 1995-96 was as follows: Technologies developed 6; Number of papers published 132; Papers presented in Conferences/Seminars, etc. 220; Number of sponsored projects taken up 21; Consultancy projects 19; Patents 7; Processes passed on to industry 9; Processes demonstrated 6.

The area-wise R&D accomplishments during the period include:

Corrosion Science and Engineering

Studies in the area of corrosion science and engineering deal with the various aspects of deterioration and destruction of metals and materials:

Concrete corrosion — A rapid repair technology based on sulphur concrete has been developed and field tested. This is ready for exploitation now.

A shop coating based on cement-polymer composite material was developed earlier for corrosion protection of reinforcing steel and prestressing steel. Now, the automation of this technology has been standardized. The entire process of sand blasting, preheating, primer coat and finish coat application for a 12 m long standard reinforcing steel rebar could be completed within an hour. Predesign cost estimate for a 6000 tonnes plant has also been worked out.

Development of antiscalants — The polymeric antiscalants based on polyacrylate and polymaleate have been developed and tested for their antiscaling efficiency. At a concentration of 2 ppm of the polymer, nearly 90 to 95% antiscaling efficiency has been achieved.

Protective coatings — A multi-coat paint system with good acid and alkali resistance has been developed. It is specifically suitable for steel structures in chlor-alkali industry.

For indoor protection of copper and brass articles against tarnishing, a water soluble lacquer, consisting of polymeric material and inhibitors, has been developed.

Cathodic protection — Investigations on the turnkey project regarding design, fabrication and installation of Cathodic Protection System for Jetty Piles at the Madras Port Trust have been completed.

Instrumentation for corrosion monitoring of second road Thane Creek Bridge, Bombay, has been undertaken under the sponsorship of MOST, New Delhi.

Prototype developments — A prototype monitor for measuring coating integrity on metals *in situ* has been developed for assessing the quality of the paint coatings. This will be highly useful for field

Corrosion monitoring probes at second road Thane Creek Bridge, Mumbai evaluation of coating performance on various structures exposed to marine and industrial atmospheres. A novel reference electrode for flow systems based on silver-silver chloride has also been developed.

Interlaboratory collaboration—The consultancy programmes in progress under collaboration with SERC, Ghaziabad, are: Instrumentation of new Thane Creek Bridge, Mumbai, and; Instrumentation of Airoli Bridge, Mumbai.

A major CSIR multi-laboratory project under TAB Engineering has been formulated and submitted for consideration by CSIR. The title of this project is 'Technology assessment and rehabilitation of prestressed concrete girder bridges affected by corrosion'.

In collaboration with RRL Thiruvananthapuram, a programme on 'Corrosion and protection of cast aluminium metal matrix composite' has been submitted to CSIR.

New initiatives — Cathodic protection of concrete structures is a challenging task. It is proposed to use fly ash, a waste product, in paint industry. For corrosion monitoring of pre-stressing cables for prestressed concrete bridges, solution is being evolved by using random-shot approach. Development of multi-functional water-treatment chemicals, metal oxide-based coating for corrosion protection of steel and pipeline inspection systems are some of the new initiatives.

Batteries and Fuel Cells

R&D in Batteries & fuel cells is one of the prominent activities of the institute. It aims at catering to the needs of small, medium and large-scale industries. The main thrust is on the development of high-energy density systems:

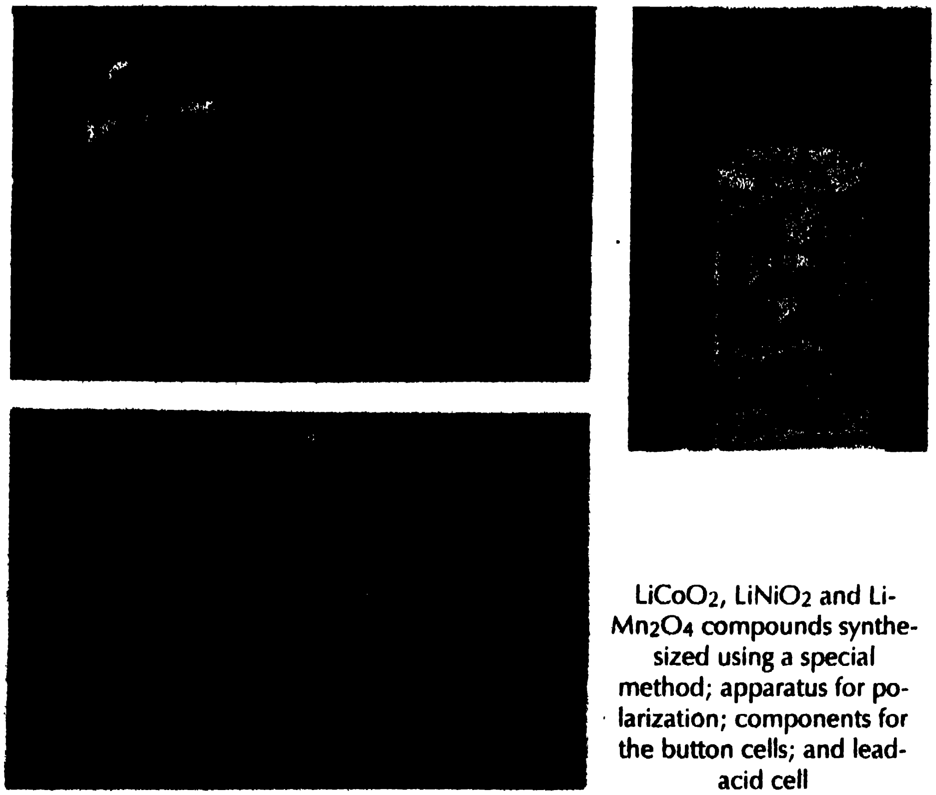
High capacity valve-regulated lead acid battery — Since the demand for higher capacity VRLA battery is increasing at a fast rate, developmental work on this aspect has been initiated. A few cells of 2V, 180Ah sealed type have been assembled and tested for capacity. Steps to procure ABS container are under way to obviate the container leakage problem.

Rocking chair cells — $LiCoO_2$, $LiNiO_2$, $LiMn_2O_4$ compounds were synthesized. Solutions in suitable media of Li and Ni/Co/Mn salts were thoroughly mixed for homogenity to find out suitable solvent, system for lithium cells. Cycling of the products was done in a suitable medium for obtaining the efficiency of operation.

Lithium MnO_2 cell — Lithium batteries (button type) were fabricated and tested for life and performance. The cells were discharged at 500, 200 and 100 micro amps. The efficiency of discharge of these cells was respectively 60%, 70% and 90%. The cells showed no fall in voltage (~3.0V) for a continuous period of three months at 50°C showing the shelf life of the cells to be around six years.

The processes ready for commercialization are: Li/MnO_2 coin cells of 22.5 mm dia ×5 mm thickness of 500 mAh capacity of low drain, and fine granular Ag_2O powder of high capacity.

Indo-French project — Conventional batteries have low voltage and energy density. They are not much useful in space, miniaturized consumer electronic goods and electric vehicle applications. To develop high voltage cathode materials, cell design and fabrication of 4 volt intercalation compounds for



$LiCoO_2$, $LiNiO_2$ and $LiMn_2O_4$ compounds synthesized using a special method; apparatus for polarization; components for the button cells; and lead-acid cell high energy density lithium batteries have been taken up under the sponsorship of Indo-French Centre for Promotion of Advanced Research.

Al/MnO$_2$ dry cell — Aluminium is an attractive primary anode which, scores over zinc in varied aspects like high electrochemical equivalence (2.98Ah/g vs 0.82 for Zn), high standard negative potential (-1.66V vs -0.76 for Zn), etc. Development of Al/MnO$_2$ dry cell could open up newer horizons for Al industries. A typical Al dry cell of 'D' size configuration consists of the following cell components: Anode (aluminium on its alloys); Cathode (MnO2); Electrolyte (aqueous AlCl$_3$ + NH$_4$Cl).

The developmental work on Al/MnO$_2$ dry cells at CECRI involved: Fabrication of Al/Al alloy cans; Optimization of cathode bobbin; Optimization of electrolyte composition; Assembling and testing. Investigations on shelf life characteristics and enhancing current capabilities of these cells are in progress.

Electrochemicals

Preparation of specific organic chemicals through occurrence of selective reaction at the electrodes in the reactor is a charming proposition of electrochemical processes. Intensification of the rate of reaction in the electrochemical cell is attributable to hydrodynamic and mass transfer characteristics. Improved electrode activity results in higher current efficiency and yield. Improvements in the electrochemical processes for preparation of chemicals via reduction-oxidation methods to bring down the cost of manufacture on one hand and exploitation of the opportunities for electrosynthesis on the other, are being carried out.

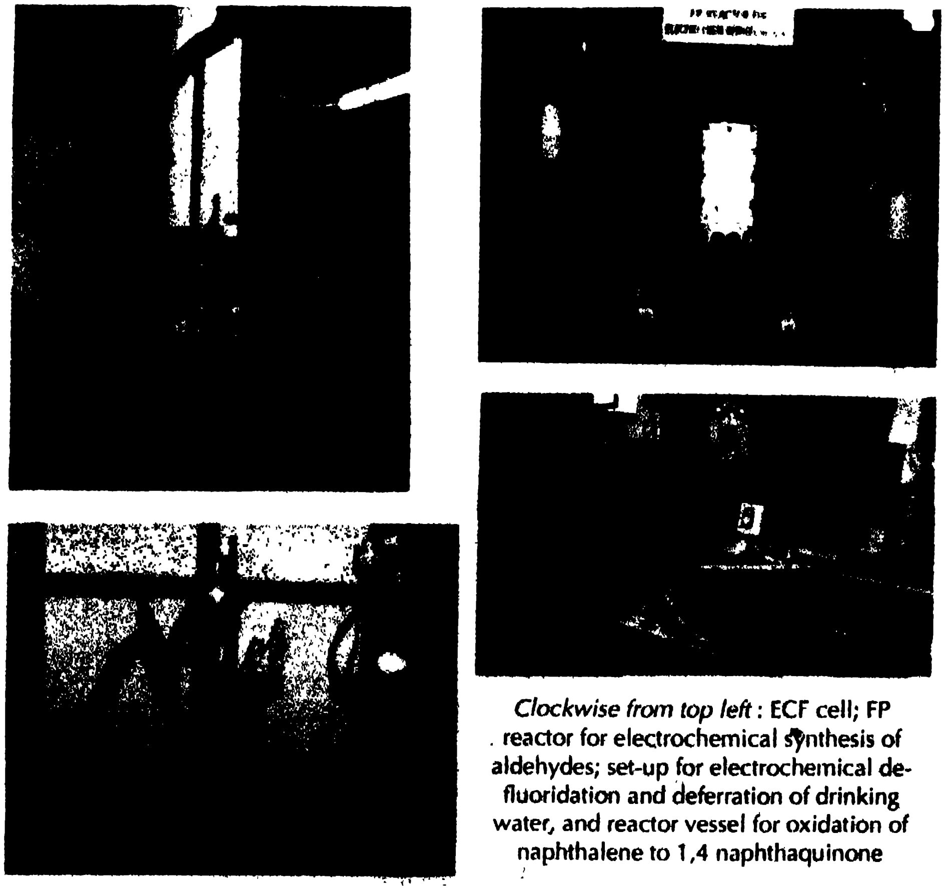
Electrochemical fluorination — Development of process technology to produce the perfluorinated compounds in quantities sufficient for commercial exploitation is an ongoing programme. Operating parameters for the electrochemical perfluorination of triethylamine and tributylamine were optimized.

For advanced studies on the mechanism of electrochemical fluorination, a collaborative research programme between CECRI, and University of Duisberg, Germany, is in progress. The research programme is being funded by Volkswagen Foundation of Germany. A dual purpose electrochemical fluorination cell is being fabricated for attacking the mechanistic problems from the electrode effect angle. A low temperature cryostat and other accessories are being procured from Germany for this programme.

Sodium gluconate — An improved electrochemical process for the direct synthesis of sodium gluconate from glucose has been developed at laboratory (10-15A) scale. The new process is cost effective as it avoids the use of intermediates.

Indirect electrosynthesis of aromatic aldehydes — Studies are in progress to develop electrochemical processes for the synthesis of aldehydes using cerous/ceric mediator. Following aldehydes have been synthesized: *p*-Tolualdehyde from *p*-xylene; chlorobenzaldehydes from chlorotoluene; *p*-methoxy benzaldehyde from *p*-methoxytoluene and; trimethoxy benzaldehyde from trimethoxy toluene.

Work was also carried out on the syntheses of : 1,4-naphtha- quinone using Ce^{3+}/Ce^{4+} redox system, 2-methyl 1,4 naphtha- quinone



Clockwise from top left: ECF cell; FP reactor for electrochemical synthesis of aldehydes; set-up for electrochemical defluoridation and deferration of drinking water, and reactor vessel for oxidation of naphthalene to 1,4 naphthaquinone (synthetic Vit.K_3),*p*-acetoxy benzaldehyde, ortho-chloro benzylamine from ortho-chloro benzonitrile, monochloro-*p*-xylene, polysilanes, diacetone 2-keto-L-gulonic acid (vitamin C intermediate),2-(6-methoxy-2-naphthyl) lactic acid (an intermediate for Naproxen), eosin and erythrosin, electrochemical carboxylation of aldehydes; electrochemical defluoridation and deferration (Rajiv Gandhi National Drinking Water Mission), electrochemical separation of cerium (IV) oxide from rare earth chlorides; and paired synthesis of antimony trioxide and sodium hydroxide.

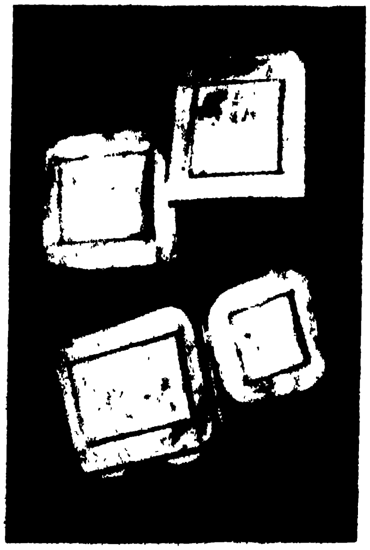
Electrochemical Materials Science

Some of the materials of interest to electrochemistry include high-efficiency luminescent materials, photoconductors, solar energy materials, conducting polymers, ceramic materials, etc. The R&D undertaken relates to the process development for preparation of materials for high efficiency fluorescent lamps and colour TV screens, photoconductive cells, photoelectrochemical cells, solid state photovoltaic cells, conducting polymers and battery and fuel cell applications.

Phosphors — Successful field trials on the CECRI, developed triblend phosphors were carried out at the Lighting Division of Crompton Greaves, Mumbai.

Conducting Polymers — The environmentally stable and economically viable conducting polymer, polyaniline, has been tried for use in shielding electromagnetic radiation, dissipation of electrostatic charge and for electrochromic and battery applications. Employing polyaniline in place of manganese dioxide, rechargeable dry cells have been fabricated with an open circuit voltage of 1.3 V and short circuit current of 500 mA.

The polyaniline and polypyrrole were successfully grafted for the production of FRP conducting composites.



Clockwise from top left: triphosphor system under 254 nm exposure; electrochemical capacitors; and supercapacitors with different configurations, i.e. button, coin and cylindrical types

Cd_2SnO_4 for thermal switching — Cd_2SnO_4 powder has been synthesized through acrylamide gel for the first time. The material is orthorhombic and shows n-type conductivity. It shows a semiconductor to metal transition at around 210-225°C, indicating its usefulness for thermal switching applications.

New materials — Some of the mixed oxides like Sr_2CoFeO_5, $Eu_2Ba_2Cu_2Ti_2O_{11}$ and $Gd_2Ba_2Cu_2Ti_2O_{11}$ have been synthesized. XRD analysis has confirmed the monophasic nature of these materials which can exhibit interesting magnetic behaviour when oxygen stoichiometry is partially increased, resulting in an increased valence state of the metal such as Cu^{3+}. Electrochemical studies on these materials have been carried out to fix the potential region where there is scope for anodically oxidizing the mixed oxides (electrochemical/soft chemistry). Electrochemical oxygen intercalation experiments into these materials are in progress.

Electrodics and Electrocatalysis

Electrochemical surface science is an area of immense importance in the changing scenario of electrochemical technologies development. Studies involving electrochemical surfaces and their properties, and understanding of electrochemical interfacial phenomenon for successful development of devices, have been the main focus of the Electrodics and Electrocatalysis Division.

Sensors and Devices (Biosensors) — An amperometric glucose biosensor using glucose oxidase enzyme has been developed. A measurement kit that can detect and display glucose concentration in microamperes or mg/100 ml units has been successfully fabricated. The laboratory prototype based on oxygen monitoring is being field-tested with blood samples.

Biosensors employing microbes for the estimation of biochemical oxygen demand (BOD) and alcohol have been developed. The prototype laboratory BOD sensor, comprising CECRI developed oxygen probe and electronic measurement kit, has been field-tested at sugar and chemical industries.

Electrochemical capacitors — A new type of porous carbon, based on polymer xerogel, has been developed for use as capacitor electrode. Based on this polymer carbon, an electrical double layer capacitor using sulphuric acid as electrolyte has been designed to yield a specific capacitance of 5-10 F/g with a working voltage of 1.1V. It withstands 10^3 pulsed charge/discharge cycles. Besides, a new type of dielectric element using long chain fatty acids has been identified, Electrochemical Capacitor (EC) made thereof shows a specific capacitance 1000 μF for 1 cell.

Supercapacitors — The different systems of supercapacitors based on commercially available carbon and nickel as electrodes have been developed in different configurations: (a) button type (b) Coin type and (c) cylindrical type. The novelty of these capacitors is the use of water as solvent in alkaline solution using specially evolved electrolyte, facilitating a working voltage of 2.2 to 2.5V.

Electrochemical sensors based on modified electrodes — This project has been sponsored by DST. MHCF modified electrode has been prepared and found to exhibit Nerstian response to potassium ions in the concentration range of 10^{-5} to 10^{-1} M. Design of a flat bottomed *p*H sensor, required for the development of gas sensors for CO_2 and $NO_{2,3}$ is underway.

Electrometallurgy

The R&D activities in the area concern with the development of futuristic technologies for light metals, and titanium extraction which involves molten salt electrolysis and recovery of non- ferrous metals from aqueous electrolytes. The current interest relates to development of alternative route for electrolytic aluminium; electrorefining cell for aluminium based on the non- alloying refining technique; prototype bipolar cell and module with reduced energy consumption for magnesium production; and technology for the extraction of Ti from chloride bath.

The R&D in electrohydrometallurgy focuses on the enhancement of value addition through newer processes development and reduction in the consumption of energy through catalyzing the reaction process for higher yield.

In addition, technologies for pollution abatement are also of interest to this group. Process development for the recovery of silver and simultaneous regeneration of photographic chemicals from the effluent of film developing process are in progress. This group has also taken up the development of non-mercury cementation route for the recovery of gallium. As an extended activity in this area, the processes for the secondary recovery of non-ferrous metals are being suitably modified and adopted for treating effluents. The group has taken up the process development for treating effluent from electroplating, paper and pulp and sugar industries.

Amalgamation cell pilot plant for the extraction of gallium from Bayer liquor, set up at MALCO, Mettur Dam

The value of metals produced in India by electrolysis is of the order of several thousand million. It is pertinent to point out that electrochemical industries consume a good chunk of electricity. In the present day energy crisis associated with escalating cost of energy and dwindling resources of high grade ores, every effort has to be made to reduce electrical energy consumption besides utilizing the secondary resources of metals and alloys. Further, abatement of environmental pollution is also to be given due importance.

Gallium recovery by amalgamation — CECRI has developed a process for the extraction of gallium from Bayer liquor through amalgam metallurgy technique. To this end, a pilot plant was set up at MALCO, Mettur Dam, Tamil Nadu. NRDC has sponsored a scheme for optimization of gallium recovery by amalgamation process for

NALCO, Orissa, which is to be utilized for putting up a plant of 1 tonne Ga/annum.

The aluminate liquor of NALCO contains about 100 mg/l and 150 mg/1 of Ga and V respectively, for an alkali level of 240 g/1. Rigorous purification of the liquor from V is essential. In order to reduce the number of cells it is necessary to increase the capacity of each cell. A scaled up version of electrolytic cell of 20 g/day from 2g/day was designed, fabricated and trial runs carried out. The data were collected and the process is ready for demonstration.

Multipolar magnesium cell technology — Magnesium is produced mostly by fused salt electrolysis. CECRI has developed an energy efficient modular cell by which the specific energy consumption is reduced from 22 to 15 kWh/kg.

The use of bipolar cells for electrolysis provided better scope for energy reduction and higher space time yield. CECRI in collaboration with DMRL, Hyderabad, had developed multipolar magnesium cells, under a DRDO sponsored project, wherein the basic aspects of electrode fabrication, cell design and other operational parameters were studied. The specific energy consumption was brought down to around 12 kWh/kg of magnesium. Further studies to improve bipolar electrodes in multipolar magnesium cells include: Design and testing of different type of snugfit electrodes; Design of a more compact cell with a new port arrangement for increased space time yield and reduced specific energy consumption; and Study of tall spacer type electrodes.

Industrial Metal Finishing

The R&D programmes in this field pertain to metals and materials involving identification of improved baths and processes for production of electrodeposits and electroforms and also electroless plating for defence, communication and space uses.

Electroforming—Under the sponsorship of Liquid Propulsion Systems Centre (LPSC) of the Indian Space Research Organisation (ISRO), Valiamala, Thiruvananthapuram, CECRI has developed a process for copper electroforming cryogenic upper stage main and steering engines. Electroforming of copper-chromium and copper- zirconium alloys was investigated as per the requirements of LPSC. In the first phase of the project six chambers are to be made on the aluminium mandrel supplied by LPSC, at a cost of Rs 527,000. The total project cost is Rs 2.25 million for the fabrication of 30 engines. Electroforming of nickel-iron alloy foils of 500 micron thickness was carried out for magnetic storage applications. An elegant electroforming process has been developed for the production of nickel cavities for use in the manufacture of automobile plastic fittings.

Alloy deposition (zinc alloys)—Zinc-nickel and zinc-cobalt alloy plated specimens, with suitable passivation treatments, which are being kept exposed at the institute's Mandapam Testing Centre, were periodically examined for their corrosion performance. Suitable brightener formulations have been developed for both the above systems to improve their appearance. Baths based on succinate, acetate, chloride, gluconate, etc. were evaluated for the solution/deposit properties. Attempts were made to improve the current distribution of the alloy deposits. Alloys containing high nickel content were produced and tested for use as high surface area nickel cathodes.

Electrodeposition of nickel alloys—Amorphous nickel-iron alloys were electrodeposited from a sulphate-based electrolyte and studies on their properties are under progress. Bright nickel-palladium alloys were electrodeposited on watch cases on different undercoats and sent for industrial evaluation.

Platinum plating—Electrodeposition of platinum was carried out on Inconel tubes of 1m length, used for solid oxide fuel cells and on tin oxide coated glass panels for use in dc/ac electroluminescent and plasma displays. Two processes on 'Preparation of platinum plating solution concentrate' and on 'Preparation of platinized titanium anodes by electrodeposition' were demonstrated to a licensee. The processes included recoating of the anodes, recovery of platinum from waste solutions and analysis/maintenance of platinum baths.

Composite plating—Diamond powder-incorporated metal matrix composites were produced on mild steel discs, needles, files, snacs, etc, using powders of varying sizes adopting different designs to suit the requirement. A technical report and predesign cost estimate were prepared and the process made available for commercial exploitation.

Colouring of titanium—To improve the strength as well as aesthetic appeal and also as a measure of material conservation, colouring of titanium was studied by electrochemical methods. Colours of different shades were produced from three different electrolytes. The film thickness, potential-current behaviour, current-time behaviour, etc. were studied. Coloured surgical components were sent for industrial evaluation.

Development of electropolishing bath for light industry—M/s Crompton Greaves, Mumbai, has shown interest in electropolishing bath for light industry. An electrolyte system was developed and the samples were sent for evaluation. Further investigations to develop electropolishing solution and the technology are to be carried out.

Electrochemical Electronics and Instrumentation Engineering

The activities of the Division relate to design, development and fabrication of application specific custom-built instruments; installation, testing, calibration, service and maintenance of sophisticated instruments; and maintenance of centralized facilities and provide the required data.

Corrosion monitoring instruments—Instruments for instantaneous measurements of corrosion for monitoring corrosion of rebars are not available. Two kinds of instruments have been designed and developed: one is based on the guard ring technique where the leakage of current during the measurements is eliminated to obtain reliable readings; the other is based on the impedance at the interface. This method is well suited for corrosion monitoring of concrete reinforcing rods.

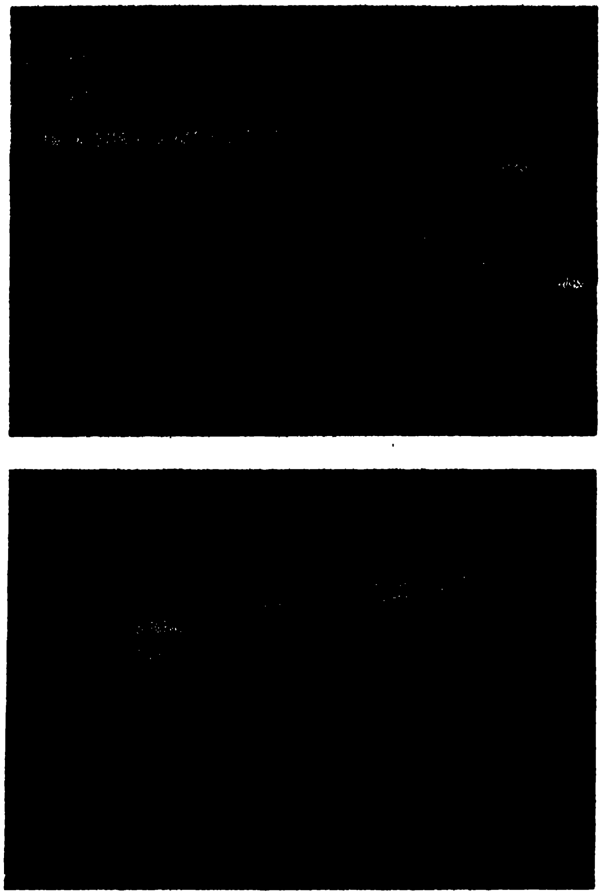
Electrochemical sensors-based instrumentation—The instruments developed include BOD meters and glucometers. Both analogue and microprocessor-based lab prototypes have been developed. These are being tried at industries/hospitals to evaluate their efficacy.

Development of custom built pulse sources—Both microprocessor and computer-controlled pulse programmers have been developed. These pulse programmers find use in metal finishing processes like pulse plating, pulse colouring and pulse anodizing.

Process monitoring/control system —A computer-based system has been developed consisting of custom-built transmitters/receivers for temperature, cell voltage and cell current. These systems have been installed in the experimental cells for development of energy reduction technology in aluminium production.

Study of polyparaphenylene in LEDs—Conjugated polymers such as polyaniline, polyparaphenylene (PPP), polypyrrole and polythiophene are new kind of polymer materials that find applications in light emitting diodes (LEDs) useful for display devices such as in computers and CTVs. Among these polymers, PPP is identified as a positive electrode for blue emission applications, and its thin films prepared via electrochemical method have been found to exhibit LED behaviour. The PPP films thus obtained have been evaluated for use in LED fabrication.

Software development — A computer program for analysis of transient data using the Laplace transform has been created, and used for the evaluation of impedance behaviour of electrochemical systems.



Computer-controlled pulse programmer and process monitoring/control system

A simulation program based on the Monte Carlo method has been developed for the adsorption studies of methane in 5Å zeolites. Software package for performance optimization of solar cells and panels was applied to analysis of current-voltage data from solar cells and panels and derive parameters characterizing them based on standard models.

R&D Activity at Extension Research Centres

CHENNAI

During the period, one round of regular monitoring (base-line data collection) along Krishnapatnam, Ennore, Madras Harbour, Cooum river mouth, Pondicherry, Cuddalore, Nagapattinam, Thondi and Mandapam has been carried out. The water quality, sediment quality and biological/microbiological characteristics of samples from these sites were analyzed. Two rounds of hot spot monitoring along the 5 transects, viz. Nagapattinam, Karaikal, Cuddalore, Pondicherry and Chennai transects have been completed.

The first ever sampling along Port Blair Coast was carried out after establishing a full-fledged analytical laboratory of A&N Centre for Ocean Development, Port Blair. It was found that except for Chatham Island transect, where suspended load was relatively high, the water quality parameters of all other transects were within acceptable limits of pollution.

Technical Assistance was rendered to various parties on batteries and industrial metal finishing.

KOCHI

Work on the Calcium Metal Project involved utilization of the 500A cell commissioned earlier for calcium metal production. Thirty kilograms of the metal was supplied to BARC. Experiments at BARC for purification of the supplied calcium metal for nuclear applications have shown encouraging results.

Samples of calcium metal were supplied to M/s Electronic Corporation of India, Hyderabad, for application in high temperature batteries.

MANDAPAM

The corrosion behaviour and biofouling characteristics of mild steel, HSLA steel and SS.304 have been studied in the Gulf of Mannar and Palk Strait of Mandapam waters.

The corrosion resistance of Zn-Ni and Zn-Co, duplex layers of Ni/Zn-Ni, Ni/Zn-Co and Zn-Ni/Zn-Co and triplex layers of Ni/Zn-Co/Zn-Ni and Ni/Zn-Ni/Zn-Co, both chromated and unchromated has been evaluated in marine atmosphere.

Investigations on evaluation of corrosion behaviour of stainless steels of Salem steel plant in marine atmosphere have also been carried out.

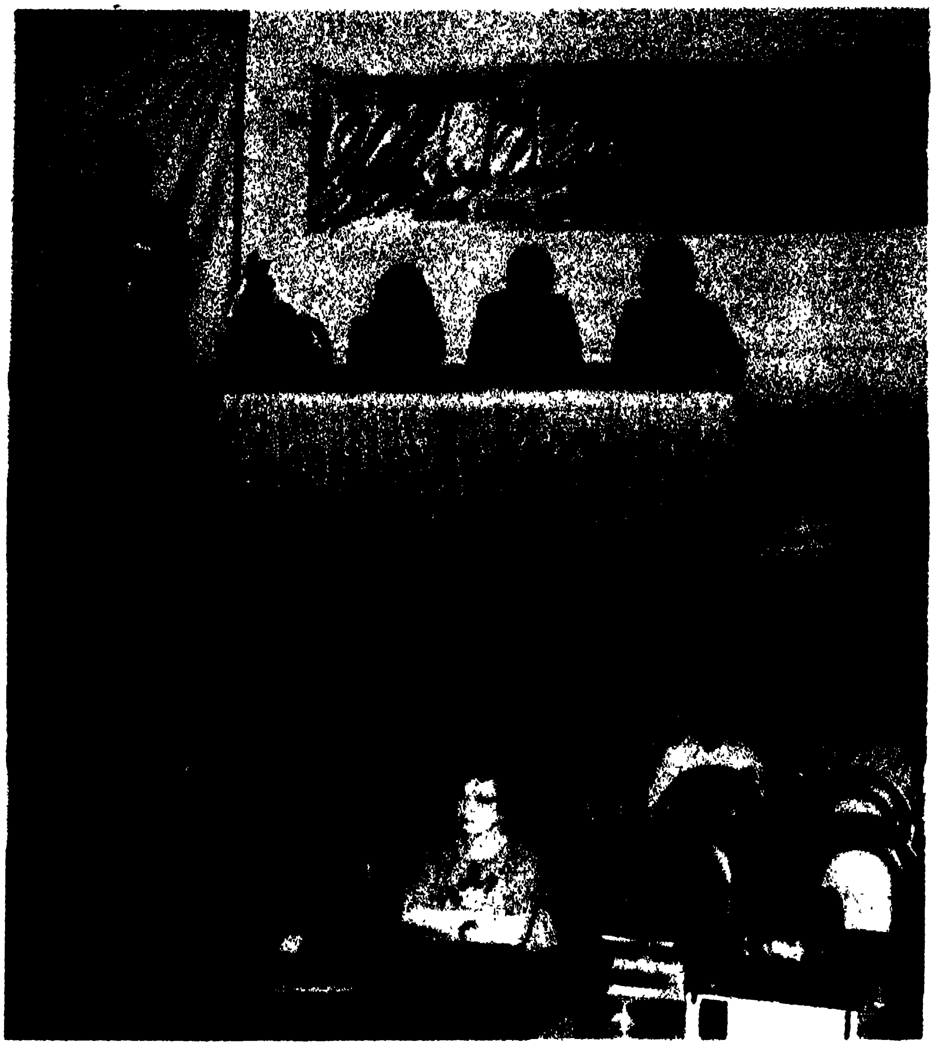
TUTICORIN

Under the project on Coastal Ocean Monitoring System (COMAPS), data were collected at the transects, viz. Sethubhava Chatiram, Mallipatnam, Thondi, Mandapam, Naripaiyoor, Gundaru, Pattinamaruthur, Tharuvaikulam, Tuticorin, Arumuganeri, Punnaikayal, Kayalpattinam, Kanyakumari and Vizhijnam. Studies on the nature of organic pollution near aquaculture units and inorganic pollution in and around Tuticorin were carried out. ❑

International Trade Exhibition and Conference on Glass & Ceramics (IGC'97)

THE first international Trade Exhibition and Conference on Glass and Ceramics (IGC '97) was held in the recent past at Mumbai. The Central Glass and Ceramic Research Institute (CGCRI), Calcutta, was entrusted with the organization of a seminar on this occasion with cooperation and support of M/s Trade Links Exhibitions Pvt. Ltd, Mumbai. An Organizing Committee was formed to hold the seminar and

Dr A.K. Chatterjee, Director & Chief Executive, Research and Consultancy, ACC Ltd, Mumbai (*extreme left*) discussing with Dr C. Ganguly, Director, CGCRI (*second from left*) at the CGCRI stall during IGC'97



Dr C. Ganguly, Director, CGCRI, delivering his address at the International Conference on Glass & Ceramics (IGC'97). Sitting on the dais (*from left*) are: Smt. Debrai, wife of Shri G. Debrai, Managing Director, Trade Links Exhibitions Pvt.Ltd; Shri A. Kakodkar, Director, BARC, Mumbai; and Dr D. Chakarborty, Convener of the Conference; and a section of the audience

exhibition of CGCRI with Dr C. Ganguly, the institute's Director, as Chairman and some others from CGCRI and Trade Links as members. Participants from foreign countries also set up stalls to demonstrate the various recently developed machinery and equipment.

The CGCRI stall was the centre of attraction to many entrepreneurs from both India and abroad. About 1000 enquiries related to problems faced by manufacturers were attended to on the spot and about 300 enquiries dealing with specific problems of glass and ceramic industries were replied by post.

About 20 speakers from India and abroad delivered illuminating lectures on different aspects of glass & ceramics. Of these, 11 speakers were from countries like USA, UK, Germany, Austria and Israel. The topics included (i) Preparation of nanocrystalline ceramic powder, (ii) Advanced materials based on sol-gel technology, (iii) Software application on insulating glass, (iv) Microwave applications for drying of ceramic tiles, (v) Isostatic pressing method for the tableware industry, (vi) TiO_2 thin films, etc.

Dr C. Ganguly in his keynote address highlighted the progress and achievements made in India on this front. The processes developed for production of optical glass, high quality special glasses like RSW, RPL, Zerodur, etc., were explained in the address.

The conference & exhibition helped CGCRI gain great confidence of the ceramic manufacturers and other users both within India and abroad. ❑

Workshop on Diagnostic Techniques

A one-day workshop on 'Diagnostic Techniques' was organized at the Centre for Biochemical Technology (CBT), Delhi, on 4 May 1997, under the sponsorship of Department of Biotechnology. It covered techniques such as Immuno-diffusion ELISA, SDS-Page, Immunoblotting, Isolation of DNA, RTPCR and DNA sequencing, etc. Twenty-two trainees from R&D institutes and universities from different parts of the country attended.

The workshop provided an opportunity to the participants to have hands-on experience on various sophisticated facilities for conducting research on infectious diseases. ❑

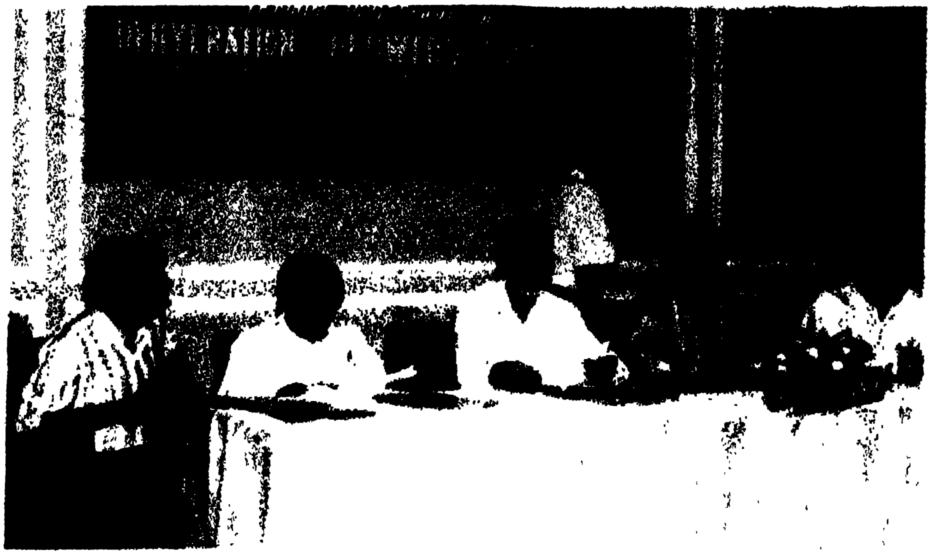
Dehydration of Flowers and Foliage

THE National Botanical Research Institute (NBRI), Lucknow, has developed a novel technique by which flowers, branches, twigs, foliage, etc, can be made to retain their fresh look and original colours for several months or even years. The technique has been standardized for a wide range of cultivated flowers, grasses, ferns, ornamental foliage, etc, and is being used extensively for dehydration of several popular and common flowers, like, acroclinum (*Helipterum roseum*), bougainvillea, candituft (*Iberis umbellata*), Chrysanthemums, dahlia, gerbera, helichrysum (*Helichrysum bracteatum*), ixora, marigold, mussanda, narcissus, nymphaea, pansy, etc. Dehydrated flowers and foliage can be used for designing distinctive and artistic greeting cards, wall plates, landscape. The technique is simple but the results are rewarding, thus making it highly suitable for interior decoration. In the recent years this technique has become very popular for self-employment generation, especially for cottage-scale industry based on floral craft for self- employment.

As a sequel to NBRI's earlier training programmes and also in view of the increased popularity of this technique among entrepreneurs, rural and urban unemployed people coupled with the great interest and financial help rendered by the banks and other funding agencies for sponsoring the training programme on dehydrated floral technique. NBRI organized an another training programme on 'Dehydrated Flowers and Foliage' under the CSIR Rural Development Programme during 22-26 April 1997 at Agri Horticultural Society, Calcutta. The training programme was jointly sponsored by National Bank for Agriculture and Rural Development (NABARD); Technical Education Department, Government of West Bengal and Agri Horticultural Society, Calcutta. The programme was inaugurated by Shri Abdur Razzak Molla, Minister for Food Processing Industries, Horticulture and Sundarban Affairs, Government of West Bengal. Prof. T.K. Bose, Secretary, Agricultural Society, welcomed the participants. Participants were also addressed by Shri S.K. Mitra, Chief General Manager, NABARD; Dr H.N. Sammadar, Project Director. Food Processing Industries and Horticulture and Dr S.S. Roy, Deputy General Manager, NABARD. Dr S.K. Datta, Head, Floriculture Division, NBRI, gave a brief resume and genesis of the dry flowers and coordinated the entire training programme with his team.

A total of 77 trainees comprising unemployed youths, students, housewives, nurserymen, amateur flower growers, businessmen attended the training programme. In the training programme the participants were exposed to both theoretical and practical demonstrations of different techniques and aspects. The training ended with a film show on 'Dehydrated Floral Craft'.

A business group meeting was also arranged with the officers from NABARD and State Bank of India to make the participants aware of marketing potentiality, loaning system so that they could start cottage-scale industry on dehydrated floral craft. ☐



Shri Abdur Razzak Molla, Minister for Food Processing Industries, Horticulture and Sundarban Affairs, Government of West Bengal *(second from right)* and other dignitaries during the inaugural function of training programme on Dehydration of Flowers & Foliage

HONOURS & AWARDS

Dr B.G. Unni

DR Balagopalan Unni, Scientist E1, Biochemistry Department, Regional Research Laboratory (RRL), Jorhat, has been awarded the Dr B.M. Das Memorial award in Life Sciences for the year 1997, for his contributions pertaining to non-mulberry silkworms. The award carries a cash prize, a citation and a plaque.

Dr Unni has made notable contributions to the area of bioenergy, utilizing agricultural and industrial wastes and non-mulberry sericulture. He has worked in a number of projects funded by Commonwealth Science Council, Ministry of Non-Conventional Energy Sources, North-East Council, etc. In 1988-91 he was awarded Fullbright Scholarship to take up Post-Doctorial Studies at Texas A&M University, USA. Currently, he is pursuing a project entitled 'Neuroendocrine regulation of silk protein biosynthesis in the silk gland of muga silkworm, *Antherae assama*', jointly funded by the Department of Biotechnology and Central Silk Board.

His contributions that have received wide acclaim relate to neuroendocrinological aspects, biochemistry of silk gland and other related tissues, consumption and utilization of biochemical constituents from the food plants related to the age of insect upon silk gland protein biosynthesis and nutritional aspects of non-mulberry silkworm. He has done extensive work in the area of juvenile hormone (JH) activating insect neuropeptides and isolation of a new insect neuropeptide called Allatinhibin from the brain of *Manduca sexta* which shuts down JH biosynthesis.

Dr Unni's research work in the area of non-mulberry silkworm has been published in the proceedings of international conferences held at Karachi, Italy, USA, Indonesia, Japan, South Africa and Brazil. He has more than 50 research papers in the national and international journals and is also guiding students for Ph.D. in Insect Biochemistry. He is associated with several scientific societies and editorial boards. ☐

Relocation of CBRI Calcutta Extension Centre

THE Central Building Research Institute's Calcutta Extension Centre office has been shifted from 6th floor to 2nd floor in the same building.

The new address is: CBRI Extension Centre, Ist M.S. office Building, 2nd floor, 234/4 Acharya J.C. Bose Road, Nizam Palace, Calcutta 700 020. ☐

Dr G. Vijay Nair appointed Director of RRL-Thiruvananthapuram

DR G. Vijay Nair has taken over as Director of the Regional Research Laboratory (RRL), Thiruvananthapuram, w.e.f. 23 June 1997. ☐

Dr S. Chandrasekhar

DR S. Chandrasekhar, Scientist, Organic Chemistry-I Division, Indian Institute of Chemical Technology (IICT), Hyderabad, has been selected for CSIR Young Scientist Award-1997 in Chemical Sciences.

Dr Chandrasekhar's areas of interest include synthesis of biologically significant compounds in enantiopure form, development of new methodologies for C-C bond formation, oxidations and reductions. In the area of basic research, the new methodology developed by him involving alkylative fragmentation of α-oxytosyl hydrazones is an important milestone. Another first and utmost important contribution is in the form of *in situ* regeneration of expensive and toxic 1,2-dichloro-4,5-dicyano quinone (DDQ) for deprotection of -OMPM ethers, which has been cited as heart cut in Chemtech. An unprecedented and regioselective oxidation of 1° alcohol while simultaneously protecting the 2° alcohol is another important contribution. Regarding his work in the area of applied research, practical appraoches for economic synthesis of pheromones of groundnut and cotton have a powerful impact on the synthesis of this class of compounds.

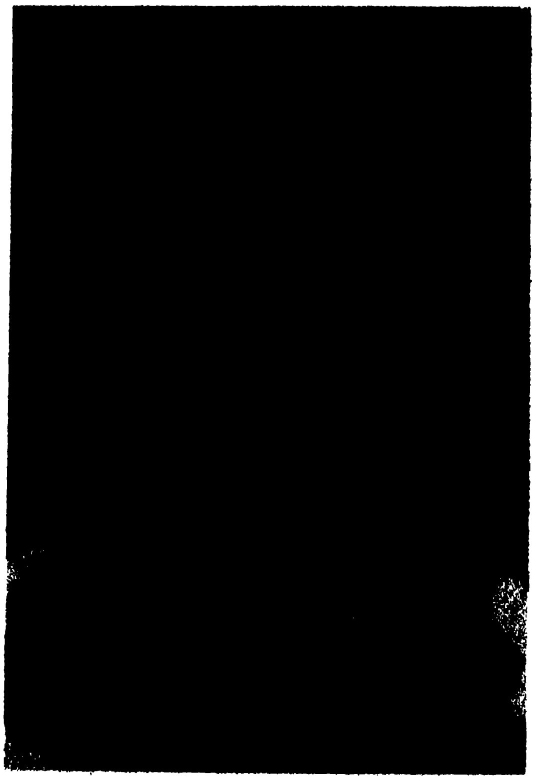
Dr Chandrasekhar is also a recipient of A.P. Akademi of Sciences Young Scientist Award-1995 and Indian National Science Academy (INSA) Medal for Young Scientists - 1996. ☐

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit
Annual Subscription : Rs. 60
Editors : Dr B.C. Kashyap and Dr C.S. Gupta   Editorial Assistant : Neelima Handoo   Production : Kaushal Kishore   Single Copy : Rs. 3.00
Phone : [illegible]786301   Gram : PUBLIFORM   Telex : 031-77271   E-mail: niscom@simetd.ernet.in.   Fax : 5787062

ISSN 0409-7467

VOL 47 NO 15 30 AUGUST 1997

CSIR NEWS



Slag-lime and C bricks, and C brick making machine based on the technology developed by Central Building Research Institute, Roorkee. A report on R&D activities of the institute during 1995-96 appears on p.226

CENTRAL BUILDING RESEARCH INSTITUTE, ROORKEE
R & D Highlights 1995-96

THE Central Building Research Institute (CBRI), Roorkee's R&D programmes encompass the following areas: Shelter Planning — Housing and Planning, Education and Health Buildings, Rural Buildings and Environment, and Efficiency of Buildings; New Materials — Cement and Lime Products, Clay Products, and Organic Building Materials; Structure & Foundation Engineering — Geotechnical Engineering, and Building Processes, Plant and Productivity, Disaster Mitigation — Building Processes, Plant and Productivity; Rural Buildings and Environment, Fire Research, and Geotechnical Engineering; and Process Development — Building Processes, Plant and Productivity.

During 1995-96, the institute pursued 11 projects under Shelter Planning, 14 under New Materials, 16 under Structure and Foundation, 10 under Disaster Mitigation, and 5 under Process Development.

A total of 50 consultancy and sponsored projects were undertaken for various parties. Two patents were filed and eight patents were renewed. Six processes, viz. Energy Efficient Gypsum Calcinator; Fire Blocking Layer for Aircraft Seat Cushions; High Draught Brick Kiln; Improved Method of Constructing Bored Compaction Piles; Epoxy/Phenolic IPN System for Protection of Steel Reinforcement in Concrete Structures; and EPS Door Shutters were licensed.

The institute continued to maintain good liaison/linkages with the Building Research Organizations all over the world through exchange of publications. It helped many organizations the world over in creating various type of detabases by attending to the questionnaires sent to the institute from time to time. For general awareness of its R&D activities, the institute organized National Workshop on Waterproofing of Buildings, CBRI-Entrepreneurs Meet on EPS Doorshutters, and a number of get-togethers and exhibitions. Training programmes for NGOs, artisans and engineers/architects from India and developing countries were also arranged. Delegations from several countries visited the institute. Its ECF during the year amounted to Rs 25.36 million, which represents an increase of about 10% over the last year.

Performance Indicators 1995-96

Institute's R&D Projects	: 56
Sponsored projects/ Consultancy	: 50
Patents filed	: 2
Patents renewed	: 8
Processes licensed	: 6
Papers published	: 48
Chapters in books and general articles published	: 7
Papers presented in seminars/conferences/ symposia	: 56
Budget	: Rs 66.807 million
External Cash Flow	: Rs 25.36 million

A major development was the signing of an MoU with the Agricultural Research and Advisory Sdn. Bhd. (ARAB), Malaysia, for offering technical cooperation in the areas of geotechnical engineering, structural engineering, building materials and termite control. Another MoU signed during the year is with UBEST, Calcutta, for jointly undertaking software related activities.

Some of the major activities of the institute are given below:

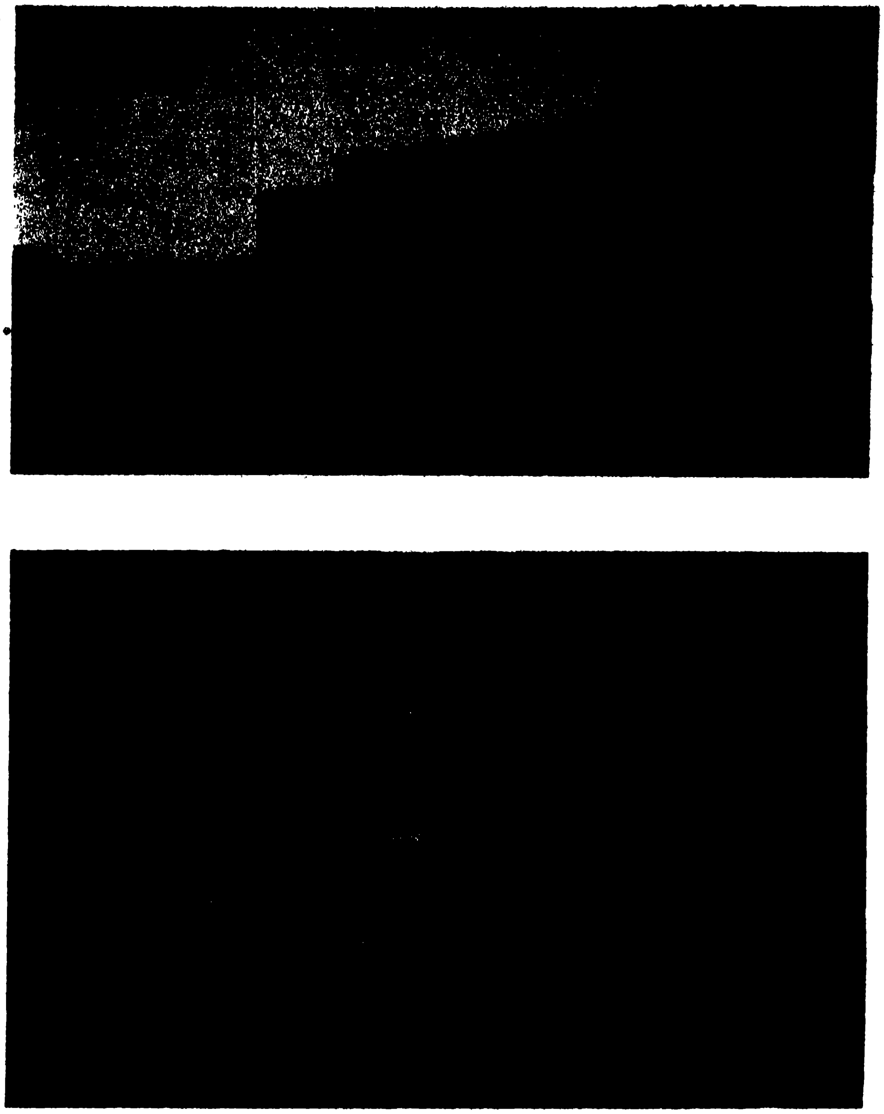
Shelter Planning

Housing Complex for NIVH - At the instance of National Institute for the Visually Handicapped (NIVH), Dehra Dun, CBRI designed three types of buildings, viz. Director's residence, VIP guest house and staff quarters on three discrete locations within their campus. Attempt was made to provide the best possible layout keeping in view the mountainous surroundings.

A computer software for simulation of thermal performance was used to evaluate thermal performance of the suggested design. It is intended to use solar photovoltaic panels (SPV) in this building with the help of Central Electronics Limited (CEL).

Project Monitoring & Feedback on Navodaya Vidyalaya Complexes — In the ongoing Navodaya Vidyalaya project, feedback studies are being conducted on the performance of the complexes built so far at various locations in the country.

The feedback information relates to: architectural, structural, foundation, internal water supply, drainage and electrification & campus planning features for about 31 selected sites. An extensive survey programme was prepared for all the



School building and staff quarters of JNV, Chandigarh, designed by CBRI

selected sites, keeping in mind the different geo-climatic regions, construction material & technology, type designs and construction agencies, and number of teachers and the students.

Design of Kendriya Vidyalaya Complexes at Dehra Dun and Chandigarh — This project has been sponsored by IIP, Dehra Dun. Complete school complex consisting of one school building for about 1500 students, Principal's residence and staff residences has been planned. The school building based on CBRI design will provide better space utilization besides noise, visibility and light aspects. This will not only provide more functional requirements and inner environment but will also be cost effective.

Buildings of JNV, Chandigarh have been constructed based on a special design keeping in view shortage of space at the site.

Rural Building & Environment

An ambitious project in this area is the development of a computerized database for rural building materials and systems. In the absence of a consolidated database it is difficult to take decision about the suitability of a particular technology or material for a given region and also to assess its cost effectiveness. A project has been undertaken to help in decision making and dissemination of available knowledge.

Efficiency of Building — The projects in the area of building physics are progressing well. Studies were carried out on noise level of some of the highrise buildings in New Delhi.

Investigations on the effect of external projections on wind pressure distributions on low-rise buildings were carried out. Average wind pressure coefficients were determined on models with smooth wall surface and also after mounting projections thereon. These studies were carried out for horizontal, vertical and honey comb type projections.

New Materials

Performance and Durability of Multiblend Cement — Multiblend cements are not yet produced in India. The institute has taken up studies to develop such multiblend cements and investigate their distinct performance and durability characteristics. The institute has developed and finalized four formulations of multiblend cements incorporating large quantities of industrial and by-product wastes, viz. flyash, blastfurnace slag and a cheap retarder, i.e. low grade gypsum.

Studies on suitability of these multiblend cements were carried out for long-term performance & durability on sulphate resistance, perfect soundness and resistance to aggressive environments and conditions.

The performance of these multiblend cements has been found to be excellent with respect to sulphate resistance.

The optimum proportion of the constituents for maximum strength in multiblend cement has been found to be : portland cement 40 to 60%; granulated blastfurnace slag 25 to 45%; and flyash 15% by wt. in all cases.

Multiblend cements help in the utilization of industrial wastes like flyash, blastfurnace slag and cheaper inorganic mineral additive, i.e. gypsum, etc. The major advantages are reduction of environmental pollution, and requirement of much less energy than usually needed in the manufacture of ordinary portland cement.

Cementitious Binder from Phosphogypsum, Flyash and Lime Sludge — The project was sponsored by M/s Soma Papers & Industries Ltd, Mumbai.

Studies were undertaken to formulate a cementitious binder wherein 70% of flyash is used in combination with the phosphogypsum and lime sludge. The cementitious binder made using the ground flyash [4000 cm^2/g (Blaine)] is capable of giving compressive strength of 27.0 N/mm^2 in 28 days. The strength was further increased to 33.0 N/mm^2 by the addition of portland cement (<10.0%).

Development of cementitious binder will consume sizable quantities of industrial by-products such as flyash, up to 70% alongwith phosphogypsum/fluorogypsum and lime sludge. The knowledge gained on the chemistry of the cementitious system has led to the formulation of such binders which shall be considered as the futuristic material as an alternative to the portland cement.

The cementitious binder is much cheaper than the conventional cement. The utilization of these binders may save up to 45% of the cement being used in house building, particularly in masonry mortars and plaster work.

Flyash-Lime Cellular Concrete Blocks — The studies were taken up with the basic objective of environmental pollution abatement by utilization of select industrial wastes such as flyash, slag, bauxite sludge, etc. through value addition by updating the technology for the production of flyash-lime cellular concrete blocks, upgradation of technology for the manufacture of sintered flyash lightweight aggregates, and development of cold-bonded bricks/blocks from slag/bauxite sludge. Successful laboratory studies were also conducted for the development of cold-bonded slag-lime bricks. The work on techno-commercial feasibility studies involving process flow diagrams, selection and specifications of plant and machinery, plant layouts, economic estimates, etc. has been taken up.

Production Technology for Flyash Bricks and Tiles — The process for the manufacture of clay-flyash bricks developed at the institute, has been found to be technically feasible, associated with numerous social gains. Successful commercialization of process technology has been demonstrated at several locations.

The bricks prepared using the process technology conform to Indian Standard Specifications (IS:1077-1970), and require less energy during firing stage of brick production.

Also, the process technology is compatible with traditional brick production system and can be adopted without any significant financial implications.

Technology for Flyash Sand Lime Bricks — Bricks having wet compressive strength in the range of 25-70 kg/cm^2 and water absorption 15-20 per cent were produced at the laboratory by utilizing various samples of flyash having 0.5 to 10 per cent loss on ignition. Hopper ash in this technology gives better results.

A brick-making machine has also been developed. A commercial plant having a capacity of producing 3000 bricks per day is estimated to have a total investment of Rs 0.2 to 0.3 million.

Organic Building Materials

Development of Protective Treatment for the Protection of Steel Reinforcement in Concrete — Corrosion of reinforcement is amongst the most important causes of deterioration of the reinforced concrete. Concrete cracking occurs because of the production of insoluble corrosion products known as rust. Volumetric expansion caused by the corrosion products imparts internal tensile forces to the concrete, causing cracking and spalling. Development of epoxy/phenolic interpenetrating network polymer (IPN) has been successfully made in the institute. The use of this organic coating has been found to be the best solution for this problem.

Studies at the institute have shown that no cracks appeared in the concrete cubes having one coat of Nitozinc followed by one coat of IPN coated bars embedded in concrete.

The treatment is cost-effective, gives better performance and can be applied at site. The process has been licensed to two parties, viz. M/s Krishna Conchem Products, Mumbai and M/s Konkan Polycon, Goa.

Structure & Foundation Engineering

Behaviour of Reinforced Earth Retaining Structures and Foundation Beds — To demonstrate the effectiveness of earth reinforcement in reducing the lateral (active) earth pressure on the retaining wall, a new concept of earth retaining structures has been visualized in which the backfill earth of a rigid retaining wall is reinforced with either metallic or geosynthetic elements.

Two to three times improvement in the bearing capacity of soil was observed in laboratory experiments conducted on shallow footings resting on reinforced soil bed. The length of the reinforcement was varied from one to three times of the width of the footing. Total depth of the reinforced soil bed, below the base of footing, was also varied from 0.25 to 1.25 times the width of the footing.

The earth retaining structures find application in providing shallow foundations in poor/weak ground. The construction of flyover in densly populated urban areas will prove to be very economical by adopting this technology.

Development of Models for Cost Management of Building Projects - Computer-based cost models have been developed which relate the inputs with the size of tenement (plinth area), type of structure, varying range of specifications & construction techniques. The parameters like soil condition, storey height, number of storeys, plinth height, foundation depth and seismicity of the region have also been taken into account.

Different sets of statistical models were generated for each element/component of the building and for each element various alternatives/specifications were considered.

A computer software was developed for giving the material and labour requirements alongwith their cost on elemental basis and also for the complete building, in consolidated form. The statistical relations in respect to single, double & four storeyed construction for all the elements/alternatives are inbuilt into the program.

Disaster Mitigation

Behaviour of Masonry Buildings under Earthquake Conditions

In an effort to understand the behaviour of masonry under earthquake conditions, a systematic experimental and analytical study has been started. The study is expected to result in scientifically established and economically viable practices, for strengthening/retrofitting of masonry buildings against seismic forces.

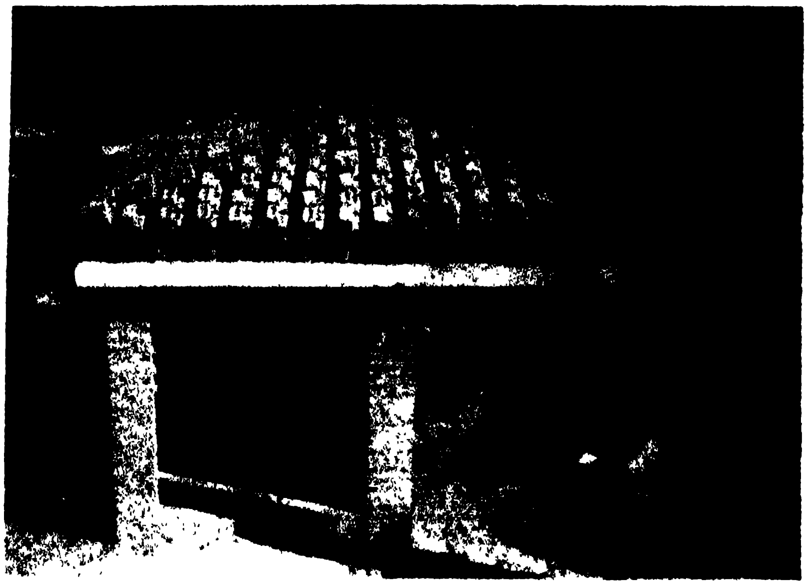
Development of Cyclone-resistant Traditional Houses — Tropical cyclones are responsible for large casualities and considerable damage to rural houses in coastal areas. Studies were undertaken for the development of cyclone-resistant houses using locally available materials and skills.

Prototype houses were constructed using unreinforced pyramidal roof, in coastal areas of A.P. and also at Hyderabad for studying long-term behaviour of roofing system under actual field conditions. Possibilities of using inferior bricks in construction of these roofs were explored and a prototype roof using mud bricks and cement concrete was constructed at the institute. The studies show that unreinforced masonry roofs with mud bricks are quite stable.

It was also found that the burnt bricks available in coastal areas could be used for the construction of unreinforced pyramidal brick roof.

Erosion of mud walls and sudden collapse of houses during rains is one of the problems in traditional mud houses in rural areas. The soil stabilizers like bitumen, cement,

Crack pattern in a brick masonry wall in a mud mortar subjected to lateral load



Prototype roof constructed using mud bricks and cement concrete, under load test

lime, etc. have been tried earlier. But due to their high cost, they are no more economical. Therefore agro-wastes like wheat straw, fresh cow dung/partially decomposed cow dung were tried to improve the water resistivity and reduce the chances of erosion of mud walls.

The studies have shown that optimum compressive strength and moisture absorption are obtained when 50% of fresh cow dung and 1.8 kg wheat straw are added per cubic feet of soil. The compressive strength thus obtained is sufficient to sustain the self load of the wall and roof. The technology will help improve the quality of life in coastal areas by providing safety to inhabitants, and security against natural forces.

Environment-friendly Buildings in Garhwal Region — A detailed survey of Uttarkashi district was carried out by the institute to study the traditional and conventional buildings, building materials, and construction practices, covering all the six blocks of the district. Problems related to building construction and possibilities of adopting new technologies were also studied. Type designs of houses for economically weaker sections were developed and appropriate construction technologies suggested based on the functional requirements, efficient use of space, socio-economic considerations, climatic conditions and structural safety.

Fire Research

Facility for Evaluating Fire Behaviour of Dry-Type Power Transformers -- The institute has designed, erected and commissioned a new facility for evaluating fire behaviour of dry type power transformers (DTT) as per CENELEC specifications. Now the manufacturers of DTT can get evaluated their transformers at CBRI, which hitherto were being sent to CESI, Italy, for evaluation as per CENELEC standards.

Fire-resistant Metal Composite Door — A complete metallic composite door with frame has been developed by the institute. The developed door has been found to pass all BIS and ISO specifications and the technology is ready for commercialization.

Microzonation of Slope Instability in Parts of Alaknanda Valley, Garhwal Himalaya — The slope stability assessment has been carried out with the help of extensive field survey and employing the Slope Mass Rating (SMR) technique. The various classes of stability have been assessed, and are found to match with the existing stability conditions. On the basis of this study, microzonation maps were prepared on 1:10000 scale.

The methodology developed for landslide hazard zonation mapping through evaluation and synthesization of various geo-environmental factor maps in relation to the frequency of landslide is simple and can be easily employed in any part of hilly terrain. The study highlights the relations between landslides and terrain factors with a view to having a better understanding of the terrain for landslide occurrence. The microzonation study precisely predicts the instability in the slopes.

Strong Motion Seismic Instrumentation Around Delhi Region — Delhi and surrounding regions are highly prone to earthquakes. With this in view, a project on the network of SM accelerographs in and around Delhi region, formulated by the institute, has been sponsored by Department of Science & Technology, Government of India, New Delhi. The information obtained on strong motion will provide valuable data on attenuation laws, response spectra, etc. and help design tall buildings to withstand earthquakes.

Process Development

Continuous Type Gypsum Calcinator — An energy efficient gypsum calcinator was developed in the institute and the technology has been in use for several years by over a dozen parties. This technology has been further improved and the present calcinator is an incremental design system having a basic unit of 8 TPD capacity. The developmental work on 50 TPD capacity continuous type gypsum calcinator has been taken up now.

In order to develop the design details of full capacity continuous calcinator, suitable for calcining a variety of gypsum such as natural gypsum, marine gypsum, and byproduct phosphogypsum, an attempt has been made to study a laboratory model of 100 kg capacity calcinator to give continuous output of 45 to 50 kg of plaster of paris per hour. Design details of furnace, pan and power stirring mechanism have been finalized and components fabricated. The construction of furnace has been completed. Assembly work on components of stirring system and its power unit is in hand.

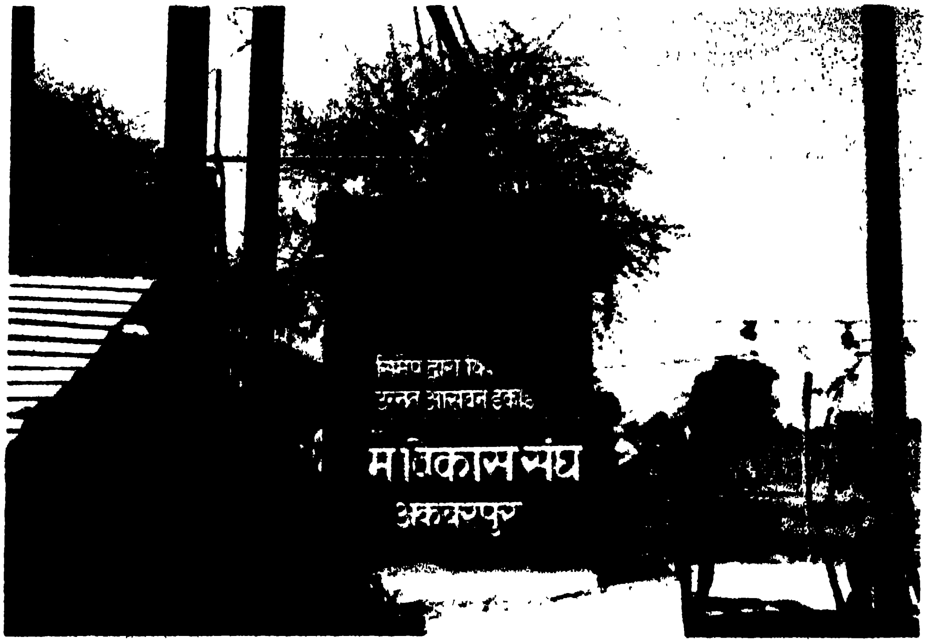
Development of Light Weight Fibre Reinforced Composite, Prefabricated Roofing and Walling Elements for Building Systems — Initial work at the institute on composite materials has shown potential of using coconut fibre and cement composites as building materials. Coir fibres act as reinforcing material, providing building components in several shapes when mixed with cement. Mechanical and other properties like bending strength, modulus of elasticity, water absorption, etc. of this material have shown encouraging results for their use as composite building materials.

Work on development of light weight fibre reinforced roofing and walling elements, using cement and coir mixes, is in progress. The cast panels were cured and their behaviour with changing weather conditions for adoption as walling and roofing components is under observation. These panels have low thermal conductivity and very good fire resistance. Basic materials being agricultural waste, the coir cement panels would be cheaper than timber, plywood and particle boards.

Pilot Plant for the Purification of Phosphogypsum — A pilot plant of one tonne per shift capacity for purifying phosphogypsum has been designed and developed in the institute. The plant incorporates major equipment such as mixers, pumps, vibratory screen, hydrocyclone, centrifuge and rotary drier. The phosphogypsum is purified by passing the uniformly mixed gypsum water slurry through a stainless steel sieve of 300-micron aperture fitted in the vibratory screen and rejecting the coarser fraction retained over the sieve being rich in impurities of P_2O_5, fluoride, organic matter, quartz, alkali, etc. The cost of production of purified phosphogypsum has been estimated at Rs 600 per tonne. However, this cost will be grossly reduced after commercial scale application of the plant to a processing load of 50 tonnes per day or to a higher capacity. ❑

Improved Distillation Unit installed in Barabanki

THE Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, has designed, fabricated and installed an improved field distillation unit in Barabanki. Installed with financial support from the Spices Board, Cochin, the unit was inaugurated by the Agriculture Production Commissioner, Shri Akhand Pratap Singh, at



Improved distillation unit, designed, fabricated and installed at Barabanki by CIMAP

Gram Vikas Sangh, Barabanki, on 5 June 1997.

About 200 mentha growers, entrepreneurs and government officials, including Shri Padam Singh, Secretary, Agriculture Export, Government of U.P. and Managing Director, Uttar Pradesh State Horticulture Marketing Federation; Dr Sushil Kumar, Director, CIMAP; District Magistrate, Chief Development Officer, and District Agriculture Officer of Barabanki were present on the occasion.

Addressing the gathering, Shri Akhand Pratap Singh stressed on the need for extension of the latest technology of mint cultivation, its high yielding varieties and improved distillation method. He hoped that the growers of menthol mint will be benefitted by this newly installed distillation unit.

Thanking the Spices Board for the financial support extended for installation of this distillation unit, Dr Sushil Kumar expressed that by the use of this unit, one will not only save fuel and time but will also get rid of the smoke at the work place.

Shri Padam Singh also addressed the gathering. ❑

Manufacture of Water Filter Candles Utilizing Clays available in and around Bhubaneswar

EVERY year a large number of people suffer from different water- borne diseases particularly during rainy season as water supplied often gets contaminated with various effluents and bacteria during this season.

Filtration of water through ceramic filter candles is one of the easiest methods to get potable water free from suspended matter as well as bacteria. In urban areas, the use of ceramic water filter candles is steadily becoming popular. Here, these candles are generally manufactured in the organized sector. However, the cost as well as non-availability have limited the use of these candles in the rural areas.

Thus, there is an urgent need to develop an appropriate technology for manufacture of these candles for obtaining safe drinking water in the rural areas. The Central Glass & Ceramic Research Institute's Khurja Centre, took up a project with special funding from the Rural Development Cell of CSIR, and developed three type of body mixes for manufacturing ceramic water filter candles: (a) Based on white burning clays only, firing temperature 1100°C; (b) Based on a mixture of white and red burning clays, firing temperature 1000°C and (c) Based on red burning clays only, firing temperature 950°C. The rates of filtration of water with these candles have been found to be 2.8, 2.6 and 2.2 litres/hour respectively as against 1.5 litre/hour according to the Indian Standards specification. The apparent porosity of the candles developed is in the range of 50 - 55% and the fired strength 16 - 22 kg/cm^2.

Workshop

The technology developed by the Khurja Centre for the manufacture of various type of ceramic filter candles was recently demonstrated in a rural technology workshop, 'Demonstration Training for Masses-1997' at Regional Research Laboratory (RRL), Bhubaneswar.

Shri T.K. Mukhopadhyay, Scientist and Project Leader; Shri C.S. Prasad, Technical Officer and Shri Rajbir Singh, Technician from the Khurja Centre demonstrated the technology to the participants. They had brought the body mixes from the Khurja Centre.

A total of 18 participants including six women from different parts of Orissa took part in the programme. The participants were mostly rural potters engaged in the manufacture of terracotta articles by throwing or coiling method.

The training programme comprised: preparation of body mix and casting slip; function of different electrolytes (soda ash and sodium silicate); fabrication of ceramic candles adopting slip casting method in plaster of Paris moulds; fabrication of candles by throwing with a plastic mass; drying and finishing of the green pieces; firing of the articles in an electric furnace; inspection of the fired pieces and fitting of caps; and fitting of the candle in a suitable container to get sediment free water for drinking purpose.

A booklet containing the details of the manufacturing process as well as the composition of all the three type of candles was given to the participants.

The workshop was inaugurated by Shri J.K. Mahapatra, Commissioner-cum-Secretary, Rural Development, Government of Orissa. Distinguished guests at the inaugural function included Shri T. Mohanty, Director, Directorate of Handicraft and Cottage Industry, Government of Orissa; and Shri S. Jena, Addl. Director, Department of Science and Technology, Bhubaneswar. This was followed by a technical session where papers were presented. From the Khurja Centre, Shri C.S. Prasad presented a paper on 'Water filter candles from common clays available in Bhubaneswar'.

The Khurja Centre's process technology created tremendous interest among the participants. The products developed by CGCRI and displayed in an exhibition organized on the occasion were also appreciated by the visitors. Shri N. Palai, District Cottage Industries Officer, DIC, Bhubaneswar and Shri G. Mohan Das, Project Officer, A.P. State Council of Science and Technology showed keen interest in the technologies developed at the Khurja Centre particularly the ones on water filter candles, glazed terracotta wares, and novelty wares of stoneware quality. Shri Palai requested for conducting a training programme for the manufacture of ceramic filter candles, terracotta tiles, glazing of terracottawares, at Nuagaon village which has a cluster of 50 potters families. ❑

Processes licensed, Technical Services rendered, Sponsored/Consultancy Projects taken up and Patents filed by CECRI

THE Central Electrochemical Research Institute (CECRI), Karaikudi, in the recent past has licensed its process on Lead Acid Batteries to M/s Usha Gautam Batteries, Hyderabad (LF:Rs 35,000, RR: 1%, period of license 14 yrs and demonstration charges: Rs 15,000).

Technical services were rendered for: Testing of organophosphonate samples for scale formation control to Neyveli Lignite Corporation, Neyveli (Rs 10,000); and Electropolishing of grids used in colour television to M/s Samtel Electron Devices, Ghaziabad (Rs 10,000).

A consultancy assignment taken up relates to rendering advice on painting of concrete *prill* tower for Madras Fertilizers Ltd, Chennai, (Rs 96,000).

The sponsored projects taken up by the institute include: (i) Evaluation of 2V/600AH and 2V/500AH low-maintenance stationary lead acid batteries, for Mysore Thermo Electric P. Ltd, Bangalore (Rs 1,60,000); (ii) Feasibility study on electro-deposited nickel-diamond powder composite coatings, for M/s Dhariwal Consultants, Kota (Rs 40,000); (iii) Development of know-how for the mediated oxidation of *p*-methoxy toluene to *p*- methoxy benzaldehyde, for M/s Jupiter Orga Ltd, Secunderabad (Rs 3,00,000); and (iv) Design and fabrication of laboratory potentiostat - 8 Nos, for Centre for Education CECRI, Karaikudi (Rs 1,60,000).

The patents filed by the institute include: 2498/D/96: A process for the preparation of polymer carbon-carbon composite electrodes and double layer capacitor incorporating the said electrode — S. Pitchumani, K.L.N. Phani and S. Ravichandran; 2267/D/96 : A process for the preparation of organopolymeric aerogel — S. Pitchumani, K.L.N. Phani and S. Ravichandran; 855/D/96 : An improved process for the preparation of sodium gluconate — P. Thirunavukkarasu and K. Jayaraman; 1533/D/96 : A device useful as an *in-situ* coating integrity monitor — Sathyanarayanan, G.V. Chari, P. Jayakrishnan, N.S. Rengaswamy, N. Panjali and K.R. Ramakrishnan; 1536/D/96 : A device useful as field corrosion rate meter for reinforced concrete structures — N.S. Rengaswamy, K.R. Ramakrishnan, G.V. Chari, N. Panjali and S. Srinivasan. ❑

CBRI - Industry Meet

AS a part of its Golden Jubilee Year (1997-98) celebrations, the Central Building Research Institute (CBRI), Roorkee, recently organized a CBRI-Industry Meet at India International Centre, New Delhi. The main aim of the meet was to make the building industry and other users aware of the S&T outputs from the institute. The CBRI scientists informed the entrepreneurs, builders, manufacturers, architects and engineers about the recently developed technologies, materials and processes knowhow. Technologies of immediate relevance to building industry such as innovative machinery, wood substitutes, fire resisting materials & system and waste recycling processes were deliberated. As many as 33 processes and technologies, which were ready for commercial exploitation, were displayed through models, charts and brochures, etc. The scientists concerned were present at the meet to discuss these technologies in details. Some of the technologies/processes displayed are:

- C-Brick making machine
- Concrete block making machine
- Pollution control device for lime kilns
- Lime hydrating machine
- Mini climbing crane
- Boring and skirting machine
- Gypsum calcinator
- Prefabrication system for mass housing
- Beneficiation of phosphogypsum
- Software for structure design and fire spread modeling
- Fire retardant textile and canvas
- Fire barriers
- Fire rated doors and windows
- EPS door shutters
- Coir-cement-CNSL boards
- Cement lime and gypsum products
- Waterproofing agents
- IPN-anticorrosive coatings
- Flyash bricks
- Polytiles
- Termite control through eco-friendly measures

The meet was inaugurated by Dr S. Varadarajan, President, Indian National Science Academy. Ms Kiran Agarwal, Secretary, Department of Urban Employment and Poverty Alleviation, Government of India, presided over the function.

Prof. R.N. Iyengar, Director, CBRI, while welcoming the Chief Guest and delegates, emphasized on the importance of such meets which not only provide a technical support to the industries but also a forum for discussing the problems faced by them. That the meet was a great success is evident from the large number of queries received on the recent R&D developments of the institute. ❑

INDIAN INSTITUTE OF CHEMICAL TECHNOLOGY, HYDERABAD

Basic Research Highlights: 1996-97

THE year 1996-97 witnessed impressive progress in several basic research endeavours at the Indian Institute of Chemical Technology (IICT), Hyderabad. Around 20 interesting developments were reported in scientific journals during this period, which would have practical implications on future chemical and biotechnologies. The notable amongst these are:

Molecular Organization in Hydrotope Assemblies

A transnational team of scientists from CCMB, IICT, University of Sydney (Australia), University of Canterbury (New Zealand) and Clark University (USA) has thrown new light on molecular organization in hydrotope assemblies. These compounds have been found to form open layer assemblies reminiscent of lamellar liquid crystals.

Sol-Gel Transition Phenomenon in Organo Gels

The IICT scientists have observed an interesting reversible temperature-dependent sol-gel transition phenomenon of gelation in water-in-oil emulsions. The micro emulsions of organo gels formed at higher temperature (> 40°C) melt on cooling and are free flowing liquids of moderate viscosity at low temperature (<10°C). The phenomenon is completely reversible. There is a good scope for immobilization of enzymes employing this technique at low temperatures without significant loss of activity.

Biocatalyst Probe

An IICT team has developed a novel method of probing the vicinity of biocatalysts compartmentalized in the water pool of cationic reversed micelles.

Chromatographic Method for Phase Equilibrium Studies

A chromatographic method developed for phase equilibrium studies has been successfully tested on aliphatic alcohols and aromatic hydrocarbons.

New Technique for Measuring Acidic Functions of Zeolites

The technique is based on stepwise temperature programmed desorption of NH_3.

Exosurface Characteristics of Cationic Liposomal Gene Transfection Vectors

The exosurface of cationic liposomal gene transfection vectors have been found to be significantly alkaline.

Conformational Sampling of Cyclic Molecules

Crown ethers serve as models for biologically active molecules. A new technique to study conformational sampling of cyclic molecules using AMBER force field has been developed. The study leads to the understanding of complex conformational behaviour of cyclic peptides.

Novel Synthetic Routes for Heterocyclic Systems

New synthetic routes have been evolved for furopyridines, furopyrido-oxazines, oxazolo-pyridines, pyrazolo-pyridines, etc. employing highly powerful electron withdrawing trifluoromethyl group induced o-alkylations.

Catalytic Version of Borodin-Hunsdiecker Reaction

Vinyl halides are proven precursors to various organic transformations, notably polymerization and cross coupling reactions. The synthesis of β-halostyrenes using novel catalytic version of Borodin-Hunsdiecker reaction has been accomplished.

Bioresolution of Racemic 2-Amino-1-Butanol

Immobilized penicillin acylase has been used for the resolution of racemic 2-amino-1-butanol by hydrolysis of its phenyl acetyl derivative with 85-90% yield and optical purity greater than 98%.

Enzymatic Reductions with Baker's Yeast

Yeast cells have been employed for the reduction of aryl and benzylic azides in a stereo selective manner.

2-Oxo(2H)-Benzopyrans through Single Step Reaction

The IICT scientists have successfully carried out zinc chloride catalyzed condensation of salicylaldehyde with R-substituted acetic acid esters and related methylene compounds to obtain 2-oxo(2H)-benzopyrans in a single step with yields in the range of 82-92%. The conventional process provides 60-80% yield.

Regio- and Stereo-selective Ring Opening of Epoxides

This new enzymatic route employs the conventionally used trimethylsilylazide in the presence of lipase to provide regio- as well as stereo-selective 2-azido alcohols without the additional step of acidic hydrolysis of silyl ethers.

Lamivudine

Lamivudine is a clinically useful anti-AIDS drug. The process of lamivudine utilizes hazardous chemical ozone. The process development for lamivudine, without involving ozonolysis reaction, has been undertaken.

Solid Acids for Nitrations and Esterifications

Studies on innovative design of solid acids for eco-friendly and gentle processing of aromatics have been undertaken. Nitration of aromatics has been achieved using a solid acid catalyst with consistent activity at room temperature. Solid acid catalysts also provide cheaper options for esterification of chemicals used in fragrance industry.

Clean Cycloaddition of CFC 1113

The conventional process yields both 4+2 and 2+2 cycloadducts. The IICT team has succeeded in employing cyclodextrin in aqueous medium to form 4+2 adduct exclusively.

Fluoride Supports for Vanadia Catalysts

CeF_3, MgF_2 and AlF_3 supported vanadia catalysts have been synthesized for ammoxidation of β-picoline with high conversion and selectivity.

Hydrotalcalcites for Tertiary Butylation of Phenol

Hydrotalcalcites have been found to be effective for phenol alkylation with isobutanol. o-Butyl, o-butenyl, 2-tertiary butyl and 2-butenyl phenols have been synthesized. These compounds find application in fragrance and flavouring compounds and in antioxidants.

Intelligent Gels for Electrophoretic Separation of Large DNA Fragments

Development of gels with exclusive properties to facilitate electrophoretic separation of very large DNA fragments has been achieved. This work has implication in human genome mapping wherein very large DNA fragments have to be separated and analyzed for gene sequencing.

Low Calorie Fats through Chemoenzymic Methods

Partial glycerides containing exclusively erucic acid have been prepared by a novel lipase catalyzed reaction, which after hydrogenation are esterified with essential fatty acids to give a fat with consistency that of vanaspati. Behamic acid containing glycerides can also be used to make zero trans, low calorie margarines containing high amounts of polyunsaturated acids.

New Marking Ink for Radiation Oncology

A new marking ink has been prepared which can be used for cancer therapy. It was successfully tried on more than 600 patients.

Novel Pseudo C2 Symmetric HIV Protease Inhibitors

New diaminodiol HIV protease inhibitors (useful for anti-AIDS chemotherapy) containing non-symmetrical aromatic nuclei have been synthesized. These molecules provide new opportunities to evaluate structure-activity relationship not studied so far in anti-AIDS therapeutics.

Azamacrolides

A novel family of alkaloids isolated from Mexican been beetle pupae is found to be responsible for exciting defence mechanism. These structurally complex molecules have been obtained in nanogrammes from insects. ❑

R&D Management Course for CSIR Senior Scientists

THE Human Resource Development Group (HRDG), CSIR, has since 1993 been organizing training programmes on 'Management of R&D' for CSIR Scientists F and above, in collaboration with the Administrative Staff College of India (ASCI), Hyderabad. These programmes are being coordinated by Shri S. Patil on behalf of HRDG. Dr B. Bowonder, Dean (Research), ASCI, has been functioning as the Course Director.

Participants of the R&D Management Course for CSIR Senior Scientists

The eighth course was conducted during 14-19 July 1997. Twenty two senior scientists from 17 CSIR labs/instts. participated in the course. The programme was designed to enlighten the scientists about recent developments in R&D management. The participants were exposed to topics on behaviour sciences such as group dynamics, motivation and creativity techniques and human resource management for enhanced productivity in R&D.

Other topics covered during the programme were: R&D marketing by Dr Sushila Rao, CARE, Hyderabad; and TQM and ISO 9000 for R&D laboratories by Shri Sudharshan, Additional GM (Quality), BHEL, Hyderabad. Case studies on Management of Multi-technology Missiles Development were presented by Dr A. S. Pillai, Chief Controller(R&D), DRDO. The other distinguished guest faculty members invited to deliver talks on various topics were Prof. D. Balasubramanian, Director, CCMB; Dr Ashok Jain, Director, NISTADS; Dr K. Raghavan, Director, IICT; and Dr T. Viswanathan, Director, INSDOC. A special demonstration session was also organized on Searching R&D and Patents Literature on WWW Internet Network. On the last day of the Programme, Dr P. Ganguly, Manager, Hindustan Levers, delivered a comprehensive talk on IPR and Implications for R&D. The course enabled the participants to broaden their vision on R&D and the human resource management. Further, it provided them with an opportunity for close interaction with their colleagues from the CSIR sister laboratories on important problems and issues of great concern. ❑

Shri S.P. Gupta appointed Joint Secretary of CSIR

SHRI Satya Priya Gupta, IAS, has joined the Council of Scientific & Industrial Research as Joint Secretary (Admn.) on 13 August 1997, after completion of the tenure of Shri Dilip Kumar. He has also been given concurrent charge of the post of Joint Secretary (Admn.), Department of Scientific & Industrial Research.

[redacted]

Shri Gupta (born on 5 January 1952) holds an excellent academic record with all through first class first position. He obtained his Master's degree in Mathematics from the University of Rajasthan and Master's degree in Social Sciences from the University of Birmingham, UK. Apart from the Gold Medals for securing first position in B.Sc. and M.Sc. and Chancellor's Gold Medal for securing highest percentage of marks in the Faculty of Science during the years 1971, 1972 and 1973, Shri Gupta also received Birmingham Chamber of Commerce Award for securing highest marks in Diploma in Development Administration in 1986.

Shri Gupta has attended a number of foreign training courses, including training course under the Colombo Plan at Birmingham, UK; 'Privatizing Power in Emerging Economies' at Washington and programme on 'Utility Regulation and Strategy' at Florida, USA.

Shri Gupta joined the Indian Administrative Service in 1975 and was allotted to Rajasthan Cadre. He brings with him a wealth of over two decades of administrative experience in various capacities. He has served as District Magistrate of Sirohi, Tonk and Bhilwara; Special Secretary, Food, Civil Supplies & Famine Relief; Special Secretary, Finance; and Managing Director, Rajasthan State Industrial Development & Investment Corporation. His last assignment with the State Government was that of Secretary, Mines and Power during 1994-97, when he coordinated the work related to Mines, Coal, Steel, Fertilisers, Petroleum and Natural Gas, Non-Conventional Energy Sources Ministries, GOI. ❑

Dr T. N. Singh takes over as Acting Director of CMRI

DR Tribhuban Nath Singh, Scientist 'G', Central Mining Research Institute (CMRI), Dhanbad, has taken over as Acting Director of the institute with effect from 1 August 1997. He succeeds Prof. Bharat B. Dhar who relinquished the charge after serving the institute for the last six years as Director.

Dr Singh (born, 1 July 1939) obtained his B.Sc. (Mining Engineering) degree from the Banaras Hindu University in 1963, and joined the then CMRS as Junior Research Fellow. In 1967, he was appointed as Scientist 'B'. Thereafter, he obtained two Ph.D. degrees — one from Indian School of Mines, Dhanbad and another from his *alma mater*, the Banaras Hindu University. He stepped into the world of recognition by developing 'Equivalent Mine Modelling Technique'. In 1979, he was invited to introduce the technique at the University of Newcastle Upon Tyne, UK, and was offered lectureship in the University. During his stay there, he studied the problem of mining under North sea for the National Coal Board. For his excellent work of only six months he was awarded M.Sc. in Mining by the University of Newcastle Upon Tyne. He also studied the geometry of tunnel proposed to be constructed at that time around Mecca, under the Mona Development Project of the Kingdom of Saudi Arabia.

[redacted]

He has developed a number of mining technologies which are now being successfully resorted to exploit coal, particularly from thick seams under difficult situations. A few of his developments are: Method of mechanized depillaring of thick seams with cable bolts, wide stall method of mining, etc. He has a number of patents to his credit.

By virtue of his expertise in the field of mining, particularly in method of mining, he has already carved out a niche in the mining industry. It may be added here that BCCL has recently entrusted him with a daunting task of stabilization of a certain area in Jharia Township.

In recognition of his contributions to the mining science, Dr Singh was awarded National Mineral Award (1983) of the then Union Ministry of Steel and Mines; National Coal Scientist Award (1990) of the Ministry of Coal; MGMI Gold Medal (1991); Dewan Bahadur D.D. Thacker Coal Mining Gold Medal (1993-94); Coal India Prize - J.G. Kumarmangalam Gold Medal (1993-94) and NRDC Award (1995).

He has to his credit 230 research articles either published in reputed journals of India and abroad or presented in national/international seminars, symposia, etc. He is also the author of three books on mining including the one in Hindi which fetched him the prestigious Indira Gandhi Rajbhasha Award (1994-95).

Dr Singh has been associated with a number of professional societies. He has been the Council Member of MGMI; Chairman, Institution of Engineers (India); Dhanbad Local Centre; and a few others.

He is a widely travelled man and has visted UK, USA, Germany, Poland, France and Hungary. ❑

DEPUTATION BRIEFS

Prof. G.V. Subba Rao

PROF. G. V. Subba Rao, Director, CECRI, visited the Institute of Materials Research and Engineering (IMRE), Departments of Chemical Engineering and Physics of the National University of Singapore (NUS), during 8-11 July 1997. He gave an invited talk on 'State of the art of Li-ion and Ni-MH batteries' and held discussions with Prof. C. F. Shih, Director, IMRE, and several faculty members and students. The work being done at CECRI was highlighted and possibilities of future collaboration between CECRI, IMRE and NUS were explored.

It was decided to concentrate initially on the lithium ion batteries and their development and later on start work on the Ni-MH batteries and thermoelectricity. A detailed proposal, involving the team members from both sides, laying out aims and objectives, work elements, budget, exchange of visits, etc. will be prepared and submitted for approval by both sides.

Prof. Subba Rao extended an invitation to Prof. Shih, Director, IMRE, to visit CECRI, and if possible, other CSIR labs in the near future to explore collaboration possibilities in other areas of mutual importance and expertise. ❑

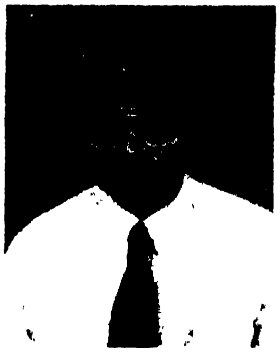
HONOURS AND AWARDS

Prof. P. Ramachandra Rao

PROF. P. Ramachandra Rao, Director, National Metallurgical Laboratory, Jamshedpur, has been awarded the INSA Prize for Materials Science (1997). This prize is awarded once in two years for outstanding contributions in Materials Science. The first award was made in 1987. The prize money consists of Rs 10,000 and TA/DA for delivering the lecture. The lecture was established in 1986 out of the Endowment of Rs 50,000 by Organizing Committee of the International Conference on 'Application of Mossbauer Effect', held in 1981.

Dr B.S.R. Reddy

DR Boreddy Siva Rami Reddy of the Central Leather Research Institute (CLRI), Chennai, has been awarded in the field of Chemical Sciences by the Tamil Nadu State Council for Science and Technology, for the year 1996-97.



Born in a small village near Nandyal, Andhra Pradesh, in 1950, Dr Reddy graduated from the Hindu College, Machilipatnam (Andhra University) in 1970 and obtained his M.Sc. from S.V.U. Post-graduate Centre, Anantapur, in 1972. He was awarded Ph.D. degree by the Madras University in 1978 for his work on 'Understanding of synthetic tanning agents' carried out under the guidance of Prof. M. Santappa and Dr S. Rajadurai. Thereafter, he worked in the field of polymer science for more than 10 years in four leading universities in UK. Currently he is a visiting professor in the Universities of Bristol and Bath in England.

Since his joining CLRI in 1983, he has made notable contributions to the development of lacquers, lacquer-emulsions and epoxide adhesives for leather and allied industries.

His research work relates to synthetic polymers — membranes for desalination, template polymers for the removal of cholesterol from dairy products, and polymer supports for peptide synthesis. He is author/co-author for more than 75 research papers in leading journals of international repute and has three patents to his credit. He has guided several Ph.D., M. Phil. and M.Sc. students of different universities, and is a reviewer of articles in several leading journals in the area of polymers. He is a Fellow of the Royal Society of Chemistry (FRSC), London.

Dr Deepak Kumar

THE XXth International Congress of History of Science which took place during 20-26 July 1997 at Liege (Belgium) under the auspices of the International Unions of History & Philosophy of Science (IUHPS) was attended by more than 1200 delegates from all over the world. IUHPS in its General Body Meeting approved the creation of an International Commission on Science and Empire with Dr Deepak Kumar of the National Institute of Science, Technology and Development Studies (NISTADS), New Delhi, as its first President. Dr Deepak Kumar is an internationally known scholar for his researches in the history of science during the colonial period. The Oxford University Press has recently brought out a paperback edition of his book *Science and the Raj.*

Another recognition of India's contribution to History of Science was the election of Dr B.B. Subbarayappa as the President of the Division of History of Science of IUHPS, the first non-western scholar to be elected to this high position. This opportunity may be taken to prepare for hosting ICHS session in India in 2005 or 2009. The Indian National Science Academy (INSA) and the Council of Scientific & Industrial Research (CSIR) had sponsored the Indian participation in the Congress.

Shri Mohammad Khalil

SHRI Mohammad Khalil, Editor, *Science Ki Duniya*, has been awarded the NCERT National Award in the Children Literature for his popular science book 'Dr C.V. Raman aek azeem Sciencedan' (Dr C.V. Raman — A great scientist. Carrying a momento and a cash prize of Rs 10,000, the award was presented to him by Shri Vishnu Parbhakar, an eminent writer and scholar, at a glittering function held at NCERT Campus in New Delhi on 25 June 1997.

Ms Vineeta Singhal

MS Vineeta Singhal of the National Institute of Science Communication (NISCOM), New Delhi, has been awarded second prize under the Department of Ocean Development's scheme to encourage Hindi, for her book *Praval evam Praval Bhittiyan* (Coral and Coral Reefs), for the year 1994-95. The award, carrying a cash prize of Rs 15,000 and a citation, was presented to her by the Minister of State for Home Affairs, Shri Maqbool Dar, on the occasion of Sixth National Scientific Hindi Seminar held in New Delhi on 8 July 1997. ❑

Shri Mohammad Khalil receiving the NCERT National award from Shri Vishnu Prabhakar

ANNOUNCEMENTS

Golden Jubilee Celebrations of CECRI and Silver Jubilee Celebrations of CECRI Madras Unit

CECRI - Industry Get-together

THE Central Electrochemical Research Institute (CECRI), Karaikudi, has entered into the fiftieth year of its dedicated service to the nation, coinciding with the Golden Jubilee of India's Independence. Also, CECRI Madras Unit is entering into its Silver Jubilee Year.

CECRI has been carrying out R&D work in major areas like Corrosion Science & Engineering, Inorganic/Organic Electrochemistry, Batteries, Industrial Metal Finishing, Pyro & Hydro Metallurgy and other allied fields.

The Department of Ocean Development (DOD), New Delhi, has established a centre at CECRI Madras Unit for Ocean Pollution Monitoring for Tamilnadu coasts and Andaman & Nicobar Islands. The Unit has also created a battery testing centre with computer testing facility for testing automotive, stationary, traction, motorcycle, miner's cap lamp type of lead-acid batteries and other batteries. R&D work is also carried out on nickel metal hydride batteries, alkaline zinc manganese dioxide batteries and silver zinc batteries. The centre has also been publishing a bimonthly *Battery Newsletter*.

To commemorate the Golden Jubilee of CECRI, it is proposed to have a year-long celebration between July 1997 and July 1998. Various science programmes such as International and National Seminars will be held during this period. As part of this programme, it is proposed to hold a Get-together with Electrochemical Industries on 24 and 25 September 1997 in the CMC Conference Hall, Chennai, where Scientists from CECRI, Karaikudi and CECRI Madras Unit will interact with the local technologists and industries.

Highlighted at the get-together will be the current activities and services offered by CECRI, Karaikudi and Madras Unit to industries/organizations. Attempts would be made to identify the requirements for additional services, facilities, and areas in which CECRI can render services to industries; and also to ascertain problems faced by the industries in the areas of services offered by CECRI. The get-together will also discuss the advances made in R&D in electrochemical industries and highlight the CECRI technologies and capabilities.

An exhibition of the recently developed products of CECRI, Karaikudi, and Madras Unit, will also be arranged.

A special souvenir will be brought out on this occasion, which will contain articles in various fields of Electrochemistry, highlighting the problems in the areas of corrosion/metal finishing, chemicals and battery industries. Eminent persons in the field will be contributing articles in the souvenir.

Those who would like to participate in the get-together and to publish advertisement in the souvenir are requested to contact the Scientist-in-Charge, CECRI Unit, CSIR Campus, Taramani, TTTI Post, Chennai-600113.

National Workshop on Catalysis

THE Regional Research Laboratory (RRL), Thiruvananthapuram,. is organizing the National Workshop on Catalysis during 11-13 December 1997.

The workshop would address to the recent trends in catalysis research. It would cover topics such as: Catalysis over layered materials; Heterogeneous catalysis; Heterogenized homogeneous catalysis; Homogeneous catalysis including enzyme catalysis; and Reaction kinetics. Experts in the specific areas are being invited to present state-of-the-art lectures. In addition to invited lectures, the workshop would have contributed papers and a large number of poster presentations.

Further details regarding the workshop can be had from: Dr M. Lalithambika, Clays & Clay Minerals Section, Regional Research Laboratory, Industrial Estate P.O., Pappanamcode, Thiruvananthapuram - 695 019.

Telephone : +91-471-490674 (O) +91-471-341477 (R),

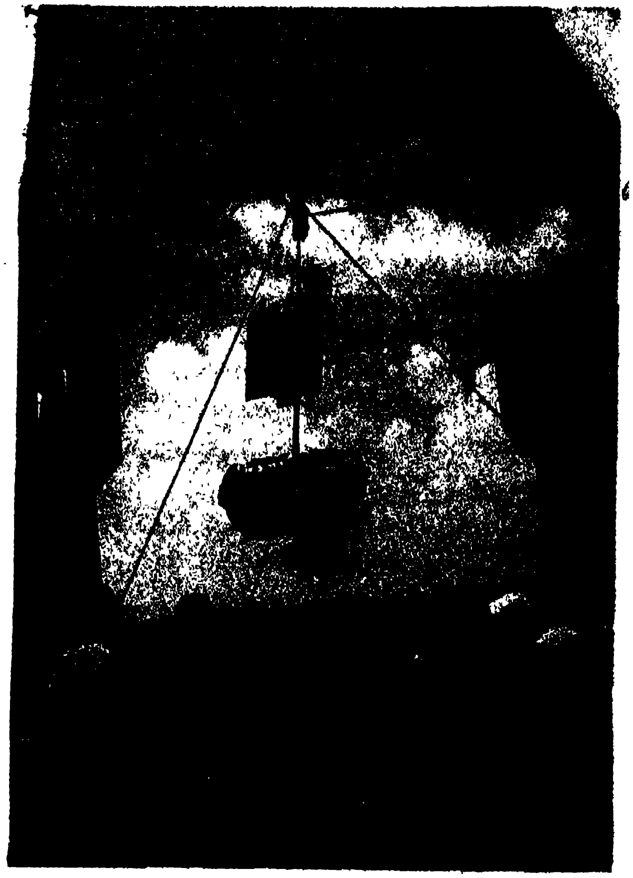
Fax : +91-471-490186

❑

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit
Annual Subscription : Rs. 60
Editors : Dr B.C. Kashyap and Dr C.S. Gupta
Editorial Assistant : Neelima Handoo
Production : Kaushal Kishore
Single Copy : Rs. 3.00
Phone : 5786301
Gram : PUBLIFORM
Telex : 031-77271
E-mail: niscom@sirnetd.ernet.in.
Fax : 5787062
RN 4512/57

SSN 0409-7467

CSIR NEWS



The National Institute of Oceanography, Goa, pursues R&D programmes in the areas of Coastal Environment, Engineering Techniques and Technology, and Offshore Processes & Resources (p.245). Seen in the photographs (anticlockwise from top left) are: Lead ingots found in the shipwreck off Poompuhar; Three stone anchors found near the dockyard; and Deployment of mooring system

World of Adhesives — R&D at IICT

THE Indian Institute of Chemical Technology (IICT), Hyderabad, has taken several initiatives since 1987 towards the development of value-added products/formulations for application as adhesives, and has successfully transferred its technologies on adhesives to 50 clients from various parts of the country. The notable among these are the automobile, aerospace assemblies and construction industries. These technologies have been commercially exploited by eight companies from Chennai, Bangalore and Hyderabad. The highlights:

Biomedical Adhesives

Cost-effective adhesives have been developed for highly specialized applications in endoscopic surgery to prevent blood loss, sutureless surgery in accidents and sports injuries and hysterectomies, in sealing of perforations in cornea, dental surgeries and as a hemostatic agent for wound healing.

The process technologies for the above adhesives have been commercialized by three companies from Mumbai and Hyderabad regions.

General Purpose Adhesives

A number of adhesive formulations have been developed on specific requests from industry, and 38 adhesive formulation processes have been transferred for commercial exploitation. Notable among these are those for shoe sole bonding, labelling, self sealing, laminating, dry cell batteries, and POCT on gum olibaum (a forest produce).

This list is not exhaustive. The small-scale industrial entrepreneurs have fruitfully utilized these technologies in various parts of the country through commercialization.

The prices of commercial adhesives manufactured by Indian companies based on the IICT technologies are nearly one-third of the imported adhesive cost. The field of biomedical adhesive has tremendous future potential in India in view of corporatorization of medical services. A substantial amount of foreign exchange can be saved by indigenous production of the adhesives. ❑

Operation Research Studies in Gold Exploration

STOCHASTIC modelling, which includes Bayesian statistics, Maximum entropy method of spectrum estimation, Markov processes, Variogram analysis and Kriging, has been found to be extremely rewarding for optimum exploration and exploitation of gold deposits.

At the National Geophysical Research Institute (NGRI), Hyderabad, geostatistical models have been developed for gold mineralization in respect of Zone-I and Oakley's reefs of Hutti gold fields. These approaches are result-oriented in drawing inferences on the persistence of gold mineralization, both laterally and depth-wise. Optimum sampling designs have been developed for estimating the mineral value properties, which have proved that the sampling size can be reduced to half of the present size without compromising on accuracy of the estimates. The recommendations of NGRI on gold mineralization have been implemented by Hutti Gold Mines Ltd.

The studies, carried out by the Geostatistics and Operation Research Group of NGRI, which is headed by Dr D.D. Sarma, have also proved to be highly helpful in modelling the gold deposits at Kolar Gold Fields. ❑

Technology Commercialized

Fire Protective Coating for Coal Mines

A bitumen emulsion-based fire protective coating material developed by the Central Mining Research Institute (CMRI), Dhanbad, has recently gone into production by Signum Fire Protection (India) Private Limited, Nagpur.

This coating material can be effectively used for prevention of spontaneous combustion in coal mines. It would, therefore, help not only in saving a huge amount of coal lost every year owing to fire in mines itself but also in minimizing environmental pollution.

The efficacy of the coating has been well proved by rigorous laboratory tests like fire resistant test, air leakage test, adherence test and washability test and the findings have been further corroborated by field trials in coal benches at Kar-

CMRI-developed fire protective coating for coal mines being sprayed on coal benches of Jagannath coal mines of MCL

katta colliery (CCL) and Jagannath colliery (MCL) which have coal of high susceptibility to spontaneous heating.

These studies have confirmed that a coating with the material developed by CMRI: (i) offers good fire resistance (ii) does not get washed down in rain water, and (iii) prevents air leakage. It forms no cracks, remains intact for a long time (more than one year) and does not create the problem of scaling off the material. Moreover, it is easy to spray and is very much compatible with coal, Hessian cloth, etc. As it is very cheap in cost, it would not create any financial burden for the coal industry for its application to prevent spontaneous heating.

It may be added here that a suitable spraying system has also been designed and developed by CMRI for application of this fire resistant coating in coal benches. The suitability of this system has also been proved during the field trials of the coating material. The machine can throw the coating material up to a distance of 10m. ☐

Technology Transfer

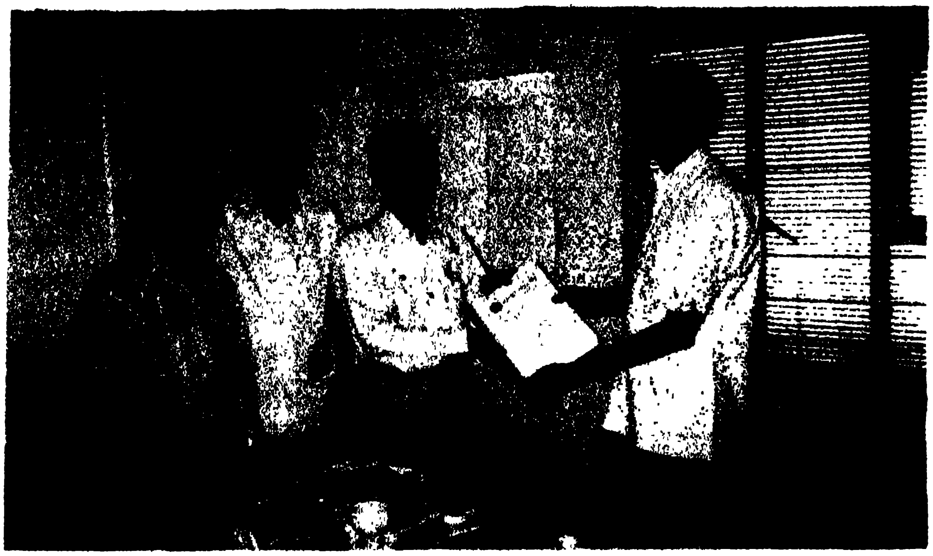
Beneficiation of Rajpardi Silica Sand for Use in Ceramics and Glass Industry

THIS investigation was carried out at the Central Glass & Ceramic Research Institute's Naroda Centre, with the aim of beneficiating Rajpardi silica sand, employing inexpensive techniques for use in ceramics, as a substitute of Rajasthan silica sand, and also to prepare a glass grade sand, by adopting commercially viable techniques, for use in glass industry.

The sands are available along with different varieties of clays occurring separately in layers as overburden materials in lignite mines in Rajpardi village of Jagadia taluka in Bharuch district of Gujarat State. The purification of sand is necessary not only for the production of traditional ceramic materials, but also for the production of optical, crystal and other glasses required to have high transparency and freedom from colour. The main colouring oxide present in glass sands is iron oxide. Iron may be present as discrete grains of hematite, magnetite, limonite or pyrite; as iron-containing minerals such as horneblende, biotite, ilmenite and garnet; or in the form of solid solution as some impurity like muscovite, sericite, rutile and zircon. It may also be present as a stain on the quartz grain or as a part of stain (like the grains coated with a ferruginous clay) or as a stain on or in some impurity such as the cracked and weathered feldspar. Iron may be present in any one, several, or all of these forms. The treatment required depends on the amount of each type of impurity present.

Such sands may be beneficiated by mechanical or chemical means to remove the impurities. The first step for the production of glass sand is to identify every mineral and stain that is present in quantities sufficient to effect the purity of the product. The second step is to organize the least expensive and the most efficient beneficiation method to remove these impurities.

Under the sponsorship of M/s Gujarat Mineral Development Corporation, Ahmedabad, an attempt has been made at the Naroda Centre to beneficiate the different types of Rajpardi sands available in abun-



Dr K.N. Maiti, Scientist-in-Charge, CGCRI Naroda Centre (*left*) handing over the technology know-how document on 'Beneficiation of Rajpardi silica sand for use in Traditional Ceramics & Glass Industry' to Shri S.B. Vora, GM (R&D & Plg.) of M/s Gujarat Mineral Development Corporation (GMDC), Ahmedabad. Shri D.R. Vyas, Sci. (*extreme left*), and Shri V.G. Malkan, Consultant, GMDC, look on

dance, for finding out their suitability for the production of traditional ceramics, replacing the silica sands from Rajasthan. Studies have also been made to beneficiate the sands employing commercially viable techniques, making these suitable for the glass industry.

Three varieties of sand are available along with plastic clays occurring separately in layers as overburden materials in the lignite mine in the Rajpardi village. These sands, viz. White Sand, Yellow Sand & Reddish Yellow Sand, were first chemically analyzed for Fe_2O_3 & TiO_2 contents which were found to be 0.63 & 0.40; 0.86 & 0.62; and 1.55 & 0.48% respectively.

Dry Sieving - Wet Sieving and Magnetic Separation Route—The sand samples were subjected to dry sieving, wet sieving, wet cum scrubbing, magnetic separation and chemical leaching techniques for reducing the contents of colour imparting impurities of Fe_2O_3 & TiO_2.

The contents of iron oxide in White Sand, Yellow Sand and Reddish Yellow Sand were brought down to 0.33, 0.65 & 1.08% after dry sieving, and to about 0.18, 0.25 and 0.35% after wet sieving.

The employment of wet sieving cum scrubbing technique did not improve the quality of sand much as compared to the wet sieving. The wet sieved fractions were subjected to magnetic separation by passing these through Eriez Rare Earth Drum (Gauss strength: 7000) and Eriez Rare Roll Separator (Gauss strength: 21070). As the availability of Yellow Sand is limited, it was not subjected to magnetic separation. The reduction in Fe_2O_3 & TiO_2 contents were found to be 90.5 and 100.0 wt % respectively in the final beneficiated fraction (third pass), using R.E. Roll separation, of White Sand on 'as received basis'. The reduction in the contents of Fe_2O_3 & TiO_2 in Reddish Yellow Sand was 94.2 and 100 wt% respectively after the final beneficiation (third pass).

Dry Sieving - Wet Sieving and Chemical Leaching Route—The sand samples after wet sieving were subjected to beneficiation by chemical leaching techniques, utilizing different chemicals, namely HCl acid (comm. grade) 1%, 2% and 1:1; HF acid 2 vol % for 48 h leaching; and HF acid 5 vol % for 24 h leaching.

The beneficiated White Sand after HF leaching in 5 vol% HF for 24 h showed a reduction in Fe_2O_3 & TiO_2 contents up to 93.7 and 100% respectively in comparison to that of the White Sand on 'as received basis'.

Upon HF leaching of the Yellow Sand with HF 5 vol % concentration for 24 h, the reduction of Fe_2O_3 & TiO_2 in the Yellow Sand was about 94.2 and 100 wt % respectively in comparison to that of the Yellow Sand on 'as received basis'.

Similarly, the Reddish Yellow Sand showed a reduction in the contents of Fe_2O_3 & TiO_2 up to 97.4 and 100.0%.

These studies have shown that the White Sand silica samples conform to the specification of 'glass grade 2 sand' according to BIS:488-1963 (Specification for Glass Making Sands) after magnetic separation. However, all the three types of sand samples conformed to the specification of 'glass grade 2 sample' after HF leaching. As HF leaching is a cumbersome process commercially, the use of magnetic separation technique, though highly capital intensive, would be a better commercial proposition for beneficiation of white sand only.

Two types of beneficiated sand samples after wet sieving-cum-washing, excluding the White sand were used in the ratio of 1:1 for the development of traditional stoneware ceramics. The fired colour as well as the quality of crockery and novelty wares produced were quite good. The developed products conformed to the requirements of the respective BIS specification.

Hence, it has been recommended that, the first route consisting of Dry Sieving - Wet Sieving and High Intensity Magnetic Separation (HIMS) route is suitable for the beneficiation of White Sand in order to produce 'Glass grade 2 sand' according to BIS: 488-1963

The technology has been transferred to M/s Gujarat Mineral Development Corporation, the sponsor of the project. ❑

NATIONAL INSTITUTE OF OCEANOGRAPHY, GOA
R&D Highlights: 1995-96

R&D activities of the National Institute of Oceanography (NIO), Goa, are grouped under: Contract Services, Coastal Environment; Engineering, Techniques and Technology; and Offshore Processes & Resources. The 'focussing process' began last year was continued and research activities with potential for industrial applications were encouraged. The emphasis was on filing patents and industry-usable products. Basic research was also made more business like by closer monitoring and clearer milestones.

The National Oceanographic Data Centre (INODC) of the institute was declared a Responsible National Oceanographic Data Centre for the Indian Ocean Region (RNODC-INDO) by the IOC Committee on International Oceanographic Data and Information Exchange. Also, India was elected to the first Council of the International Seabed Authority.

The institute continued its strong tradition of bilateral collaborative science programmes with laboratories of excellence, situated in various parts of the world. The major collaborations in 1995-96 have been with US laboratories, the focus being in the areas of biofouling and biology. Over nine different US universities and institutes were involved and the entire programme was catalyzed and coordinated by the Office of Naval Research. The European Commission programme on organochlorine contaminants was carried out with The Netherlands Institute of Sea Research. The collaborative programme with Russia was in the areas of circulation modelling and geophysics. The programme with Germany focussed mainly on maintaining the continuity of the six sediment traps deployed in the Arabian Sea and the Bay of Bengal, which have now crossed 13 years of continuous flux sampling in these seas.

Highlights of group-wise R&D activities of the institute during 1995-96:

Contract Services

The institute has enhanced its activities for undertaking contract projects related to: Environment Impact Assessment (32 projects); Geological and Geophysical Surveys (7 projects); Engineering (7 projects); Instrumentation (2 projects); and Biology (1 project). In addition, grant-in-aid was received for seven projects from the Department of Biotechnology, New Delhi, and from the Department of Ocean Development, New Delhi. External Cash Flow (ECF) during the period from contract services was Rs 88.186 million, showing an increase of Rs 1.436 million over that of 1994-95.

Coastal Environment

Environmental impact prediction — Efforts for building up a database on environmental parameters around India were continued. During 1995-96, 32 environmental impact assessment studies, along both the east and west coasts, were undertaken. In many cases, survey of larger areas than required by the sponsors was carried out. The studies covered industries that were setting up harbours, effluent discharge pipelines, construction of jetties, etc.

The coastal locations where industries are due to be erected are essentially pristine. Continuous monitoring of these waters to ensure that the environment does not degrade, will form the next phase of work in the coastal environment.

Coastal Ocean Monitoring and Prediction System — Coastal Ocean Monitoring And Prediction System (COMAPS) is an important long-term programme initiated and

Sponsored & Consultancy Projects Undertaken by NIO

1. Environmental Impact Assessment

- Environmental impact assessment for construction of bulk cargo berths at Mormugao Harbour (Mormugao Port Trust, Goa)
- Preliminary assessment on the feasibility of locating a single point mooring and jetty between Dwaraka & Lamba (BPCL, Mumbai)
- Advice on location of marine outfall and diffuser design for the disposal of effluents off Tuticorin, Tamil Nadu (Sterlite Industries Ltd, Mumbai)
- EIA studies for an accidental spillage from pipeline between Kochi & Karuer (BPCL, Mumbai)
- Assessment of marine biotic communities and EIA status around Kandla Port (IOCL, Goa)
- Marine environmental impact assessment of laying of pipeline in the intertidal area of Narara Bet (Essar Shipping Ltd, Mumbai)
- Marine EIA of a proposed petrochemical transit tankage terminal at New Vypeen, Kerala (Kerala State Electricity and Industrial Development Corporation, Kerala)
- Rapid EIA for SBM for ALCOL at Tuticorin (Aban Loyd and Chiles Offshore Ltd, Chennai)
- EIA for proposed shallow water dredging of placer deposits off Chavara, Kerala (National Institute of Ocean Technology, Chennai)
- Rapid EIA for effluents disposal off Tuticorin, (Sterlite Industries Ltd, Mumbai)
- Oceanographic conditions off Cuddalore, for an SBM installation (Pennar Steel Ltd, Hyderabad)
- EIA of release of wastewater from TCL on the ecology of Mithapur, Gulf of Kachchh (Tata Chemicals Ltd, Mithapur)
- Release of wastewaters in Amba estuary during monsoons (ATV Projects India Ltd, Mumbai)
- Evaluation of a chemical dispersant for use in the Indian marine environment [ROCHEM (India) Pvt. Ltd, Mumbai]
- Marine studies for a pipeline route and location for effluents in copper smelter and lube oil (Sterlite Industries Ltd, Mumbai)
- Impacts of MRL-CBR discharge: A conservation plant for Nagapattinam (Madras Refineries Ltd, Nagapattinam)
- Prediction of released wastewater movement and monitoring of environmental quality in Thane creek, Mumbai (Maharashtra Pollution Control Board, Mumbai)
- Marine EIA study for an SBM system in Gulf of Kachchh (IOCL, Mumbai)
- Assessment of impact of release of wastewater on the ecology of Vashisti estuary (Maharashtra Industrial Development Corporation, Mumbai)
- Marine EIA studies on impacts from release of wastewater for a soda ash factory at Sutrapada, Gujarat (EIL, New Delhi)
- Evaluation of water quality parameters around Nagapattinam (TN) for construction of jetty (Dyna Makowski Power Company, Chennai)
- Environmental impact assessment — thermal bioassay studies at Chennai (Dyna Makowski Power Company, Chennai)
- Marine EIA for proposed India pipeline segment within territorial waters of India (EIL, New Delhi)
- Comprehensive marine EIA/EMP for captive jetty and wastewater release to the sea (Indo Gulf Fert. & Chem. Corporation Ltd, Mumbai)
- Marine EIA for NIRMA soda ash plant near Bhavnagar (EIL, New Delhi)
- EIA for construction of fishing jetty at Chicalim, Goa (Mormugao Port Trust, Goa)
- Marine EIA studies for the proposed jetty near Kandla Port, Maharashtra (Indian Farmers Fert. Co-op Ltd, New Delhi)
- Evaluation of 10 chemical dispersants for their suitability in the Indian marine environment (ONGC, Mumbai)

- Marine EIA for a proposed jetty near Dahanu, Gujarat (Amma Lines Ltd, Mumbai)
- Marine EIA for SBM and submarine pipeline for a refinery at Cuddalore, Tamil Nadu (Pennar Refineries Ltd, Hyderabad)
- Oceanographic studies for a marine disposal project near Mahabalipuram off Chennai Coast (MITECH Engg. Pvt. Ltd, Chennai)
- Rapid marine EIA for cooling water of a thermal power plant at Tuticorin, Tamil Nadu (SPIC Electric and Power Corporation Ltd, Chennai)

2. *Geological and Geophysical Surveys*

- Size and chemical analysis of sediments (ONGC, Goa)
- Ground transfer of promising pipeline corridor (Sterlite Industries Ltd, Mumbai)
- Bathymetric and seabed surveys for proposed submarine effluent pipeline route off Tuticorin, Tamil Nadu (Sterlite Industries Ltd, Mumbai)
- Bathymetric and seabed survey for a submarine pipeline and jetty construction off Pillaipenimallur, Tamil Nadu (Sterlite Industries Ltd, Mumbai)
- Geotechnical investigations at Tuticorin, Tamil Nadu (Aban Constructions, Chennai)
- Search surveys off Jakhau, Gujarat for dumped contraband gold (Dept. of Revenue & Intelligence, New Delhi)
- Sub-bottom profiling for double berthing operation at Mormugao Harbour, Goa (Mormugao Port Trust, Goa)

3. *Engineering*

- Engineering design data evaluation for the construction of deep sea berth at Gopalpur, Orissa (Gopalpur Port Trust, Orissa)
- Engineering consultancy for construction of a jetty near Kandla Port, Maharashtra (Indian Farmers Fert. Co-op. Ltd, New Delhi)
- Directional wave measurements off Androth Island, Lakshadweep (Andaman Lakshadweep Harbour Works, Port Blair)
- Engineering design parameters on waves for offshore facilities off Mormugao Port, Goa (Mormugao Maritime Ltd, Goa)
- Fabrication of PVC wells for acoustic tide gauges at Goa, Tamil Nadu and the Andaman Islands (Survey of India, Dehra Dun)
- Preparation of a harbour circulation model for Chennai, Tamil Nadu (SPIC Electric and Power Corporation Ltd, Chennai)
- Studies on volume of dredging at Satpara, Chilka lake, Orissa (Govt. of Orissa, Orissa)

4. *Instrumentation*

- Development of a remotely operable sea skimmer (ROSS) for port surveys and sea truth validation exercises (National Institute of Ocean Technology, Chennai)
- Development of a meteorological tower at Canacona, Goa (Institute of Petroleum Safety & Environment Management, Goa)

5. *Biology*

- Fish spawning and breeding grounds in marine environs of Nagapattinam, Tamil Nadu (Dyna Makowski Power Company, Chennai)

Grant-in-aid Projects

- Development of appropriate technology for sustainable use of the Indian Horse Shoe Crab along the coast of Orissa (DBT)
- Applications of Geographical Information Systems (GIS) to seafloor mapping of EEZ (DOD)
- Coral and seagrass mortality in reefs: Microbial pathogens and environmental disturbances (DOD)
- Microbial fouling: Isolation and characterisation of corrosion inhibiting polysaccharides (DOD)
- Bio-geochemical cycling and sea-to-air fluxes of dimethyl sulphide in the northern Indian Ocean (DOD)
- Fabrication of two Automatic Weather Stations for the coastal research vessels of DOD (DOD)
- Collection of data on chemical parameters in Thane creek, Mumbai (DOD)

funded by the Department of Ocean Development, New Delhi. The programme aims at building up a database of long-term time series measurements to determine the level of pollutants and their fluxes with the end objective of developing a predictive model for pollutants behaviour.

Coastal and estuarine dynamics — Hydrodynamics of the Beypore estuary seem to be largely influenced by the Chaliyar river discharge contributing towards higher longitudinal coefficient of eddy diffusion, high flushing rates, increase in current shear and high sediment load. Sediment inputs to the estuary by the river over an annual cycle compared to that flushed out to sea seem to be around 3.1×10^4 tonnes.

Biodiversity and biomedical potential — Studies on biodiversity of coastal zooplanktons were carried out. Investigations on 'Development of potential drugs from the sea' involve the participation of ten national laboratories and research institutes. Twenty-three extracts of marine organisms were sent to different participating organizations (CDRI-Lucknow, IICT-Hyderabad, PGIBMS-Chennai and Department of Pharmacology, GMC, Panaji) for testing of specific activities. Fractions of extracts of organisms showing promising antibacterial, anxiolytic and oxytocic as well as inhibition of oxytocic induced contraction were screened to confirm and locate activity.

Extract from sample, NIO-*497* (a mangrove species) showed antibacterial activity against eight strains of Gram +ve and -ve bacteria. The major active principle isolated was a flavonoid. Extract from sample NIO-*450* (also a mangrove species) produced two pure compounds, flavonoid and triterpene glycoside, both identified as promising anxiolytic. Sample NIO-*450* also exhibited good antidiabetic properties.

Marine archaeology — Archaeological explorations for shipwrecks, submerged settlements, etc. in the coastal zone were continued. The lead ingots retrieved from the shipwreck off Poompuhar were chemically treated to further trace the history.

A 110 m long, 75 m wide dockyard hollowed out of the rock and datable to 17th Century AD was discovered during archaeological surveys on the river bank of Vaghotana, three km from Vijaydurg fort (Maharashtra). There were a few triangular and grapnel stone anchors adjoining the dockyard.

Engineering, Techniques & Technology

Captive port at Kharo creek, Kachchh — Studies on waves, tides, currents and sediment transport were carried out at Kharo creek, Gujarat, to assess the suitability of a proposed location for the development of a port.

Wave directional spectrum — Studies on wave direction in shallow waters (8 m) were accurately evaluated for the first time as a function of frequency. Such information is important for assessment of dynamic effects on offshore coastal structures.

Instrumentation — One land-based weather station was delivered to ONGC, Margao in June 1996 and another unit was installed at NIO for a study of coastal winds.

The development of a compact Ultraviolet Spectroradiometer (with funding from the Department of Ocean Development) was initiated. Under the Remotely Operable Sea Skimmer (ROSS) project, a craft is being designed to float mostly below (80% submergence) the sea surface, and to carry an echosounder, a GPS (Global Positioning System), sensor module, a temperature sensor, and other options of a chlorophyll sensor. ROSS is controlled by UHF radio modem commands, and can be made to move in user commanded directions. The ROSS is a project carried out jointly with the Ocean Engineering Centre at IIT, Chennai.

Tide gauge — Performance of pressure transducers for sea level measurements under different flow conditions, waves and combination of flows and waves, and turbid natural waters, was evaluated. Three PVC stilling wells for air-acoustic tide gauges were fabricated and installed at Goa, Chennai and Port Blair, as a successful pilot project on indigenous fabrication of the imported gauges. All future stilling wells for air acoustic gauges will also be produced indigenously.

Antifouling isolate — A compound, active against biofoulers, has been isolated from a marine sponge. Its structural formula has been determined, and a patent application filed on the process of isolation of this natural antifouling compound. The compound has great potential as an environment-friendly antifouling agent in place of the hazardous chemical toxins presently used in marine paints.

Corrosion studies — Microfouling and natural deterioration studies were initiated on copper panels immersed at a depth of 1 m at Dona Paula Bay for varying lengths of time. The biofilm formed on the panels was analyzed for TVC, total biofilm weight, chlorophyll content, protein, carbohydrates and particulate organic carbon (POC).

Offshore Processes & Resources

Bay of Bengal — Investigations were carried out on the physical properties of this enclosed Bay on the eastern coast of the country. Studies were undertaken to understand the influence of the southwest monsoon on the Marine Atmospheric Boundary Layer (MABL) processes, the annual and interannual variability of precipitation and precipitable water over the tropical Indian Ocean and the impact of El-Nino Southern Oscillation (ENSO) events on the Indian rainfall.

NIO now has four-year satellite estimates of the higher rainfall that the Bay receives vis-a-vis the Arabian Sea. Harmonic analysis of the monthly mean rainfall showed that annual wave at the head of the Bay had an amplitude in excess of 250 mm/month followed by lower amplitudes in the Western Indian Ocean especially off the Arabian and East African coasts. Satellite altimetry has also indicated the presence of anticyclonic gyres in the Bay interior, while hydrographic investigations carried out during August '95 as a part of our WOCE India activities to estimate zonal volume transport, indicated the presence of a cyclonic eddy in the upper 200 m. Initial hydrographic analyses in the Central Bay indicate that Sea Surface Temperature (SST) and the strength of the Western Boundary Current (WBC) could be used as precursors to monsoonal activity. These studies would lead to the development of an integrated approach to study all the processes of the Bay, during the Ninth Plan.

A 3-dimensional, 18-level diagnostic circulation model was developed for the western tropical Indian Ocean north of 20°S and up to 80°E.

The model results reproduced realistic sea surface topography and the associated circulation for all the seasons. In the southern tropical Indian Ocean (south of 10°S latitude), the computed sea surface topography patterns did not show much variability, reflecting the absence of seasonal variability in the wind field.

A 3-D semi-diagnostic circulation model for the above area and under identical forcings resulted in better initial fields for velocities, temperature and salinity with better parameterization in the sea.

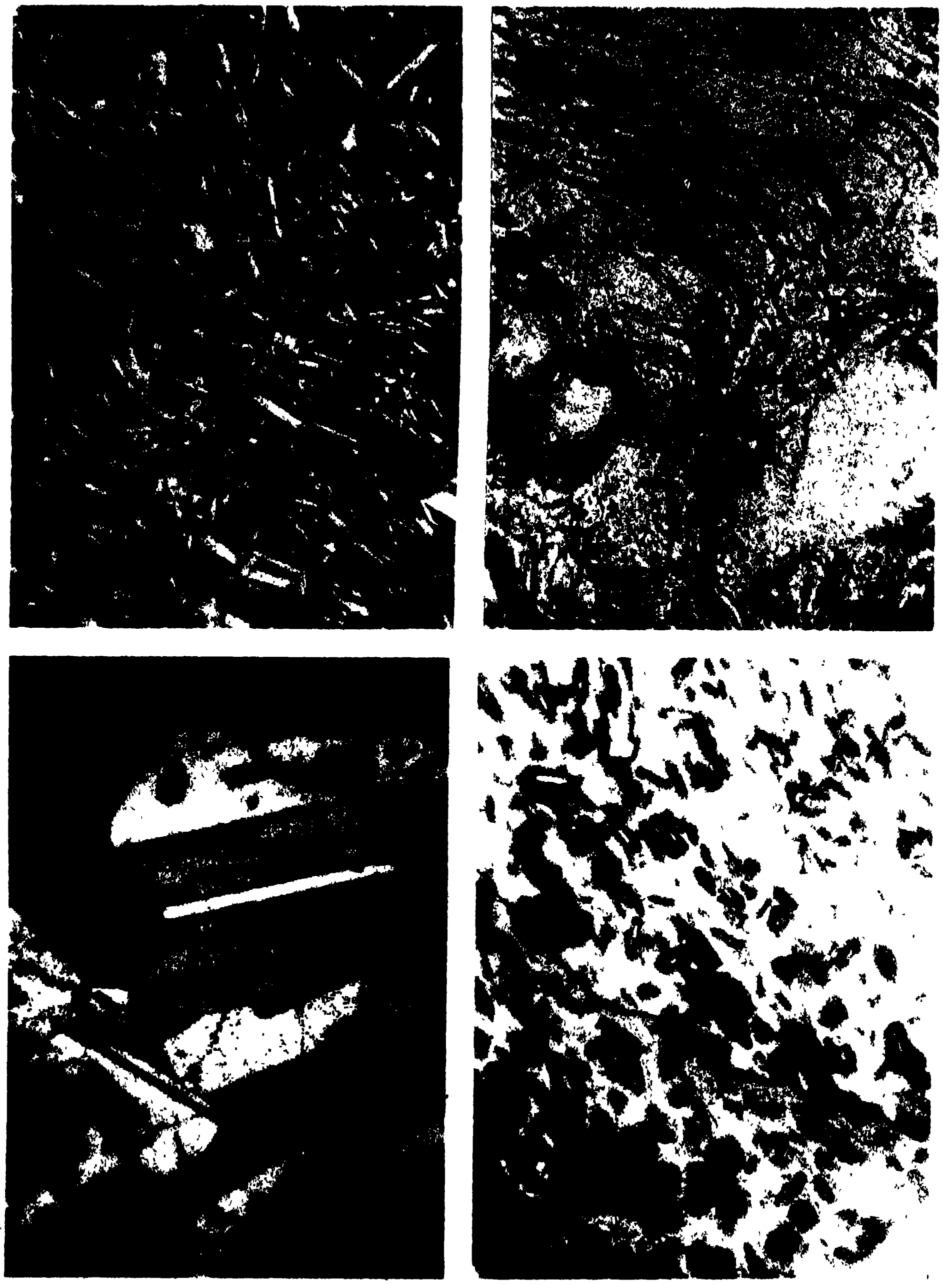
Arabian Sea — The Arabian Sea received greater attention in terms of the study of chemical processes. The JGOFS (India) cruises data showed seasonality in the oxygen, nutrients and carbon dioxide levels. The south-western monsoon cruise of 1995 showed upwelling in the northern Arabian Sea. A sinking induced by convergence in the southern portion with a strong lower atmosphere Findlater jet is also being monitored during this cruise. Significant remineralization at mid-depths has been found to lead to *suboxic* conditions and profiles of the dual isotopic composition of nitrous oxide in suboxic waters fractionated during intense denitrification have shown these to be isotopically the heaviest on our planet.

Seasonal variability of the total and partial pressures of CO_2 showed distinct northsouth gradients in the surface layers. Winter cooling and connective mixing accounted for higher CO_2 levels during this period compared to the intermonsoon, though the flux of CO_2 to the atmosphere was found to reach a maximum during the monsoons, suggesting that physical, rather than biological processes, were the controlling factors in this process.

Under JGOFS (India) programme, seasonal and spatial variations in bacterial and picoplankton abundances and bacterial production (thymidine incorporation rates) were determined in the water column up to 150 m at several stations in the central and eastern Arabian Sea.

Variability of the Asian Quaternary monsoon — High resolution studies of marine microfossil indices of upwelling from samples of the ODP site 723A off the Oman Margin, covering the last 19 Ka, suggest that the monsoon was more vigorous during the last glacial maximum, 18 Ka, rather than the inter-glacial period 15.8 Ka to 12 Ka. The commonly held hypothesis suggested by climate simulation models that the SW monsoon was linearly related to ice-sheet thickness has thus become quite questionable. This finding opens up interesting speculative possibilities on the completeness of present day climate models. It has been proposed that benthic foraminiferal accumulation rates (BFAR) are influenced by the dissolved oxygen concentrations in the bottom waters, and, one can therefore not use the BFAR as a productivity tracer in the oxygen minimum zones (OMZ).

Geology & Geophysics — A probable date of 42 Ma for the merger of Indian and Australian plates has been suggested based on the geophysical data. The 86°E Fracture Zone possibly acted as a transform fault type between the two plates. A model to account for the evolution of extra oceanic crust in the Bay between the 86°E FZ and the 90° East Ridge has also been proposed, whilst in the Arabian Sea, near *Lakshmi Ridge*, magnetic anomaly patterns have been found to allow the inference of rift propagation as the dominant mechanism in the evolution of the ocean floor.



Mineral arrangement of Central Indian Ocean Basin (CIOB) seamount rocks. Its affinity to mid-oceanic ridge basalts (MORB) in terms of mineralogy, texture and chemical composition suggests their formation at the spreading ridge crest about 50 Mabp.

The occurrence and composition of seamounts, combined with Seasat gravity and stress data, pointed to two major collisions which occurred between the Eurasian and Indian plates around 58.2 Ma and again around 51.6 Ma.

Studies on the distribution and morphology of ancient seamount chains (50 Ma) in the Central Indian Ocean Basin (CIOB) suggested slow eruption of a minimally fractionated N-MORB magma. In terms of chemistry and morphology, CIOB seamounts are indistinguishable from seamounts across slow spreading MAR and fast spreading FPR.

Polymetallic Nodules – During 1995-96, the Department of Ocean Development Project 'Surveys for Polymetallic Nodules', in the Central Indian Basin, entered into a new phase with emphasis on simultaneous collection of spot samples and deep sea photographs.

The methodology and integrated data sets of still and video photographs, spot and grab sampling for phased relinquishment of the nodule site area in the Central Indian Ocean, was prepared and presented to the Department of Ocean Development for their use as the Relinquishment Document to the International Sea Bed Authority.

Rock sample with features resembling hydrothermal vents collected from the Andaman Sea

Andaman Backarc Basin — Geophysical studies in the Andaman Seas allowed the delineation of two ridge segments along the Backarc Ridge, one of which is active. The surveys also showed the Backarc Basin to be a complex morphotectonic structure. Sampling in the rift valley of the active ridge segment and in a crater of a seamount yielded volcanic rocks which contain vent like features, broken parts of chimney like structures and rocks with disseminate and vein type metal sulphides. These assemblages together with the presence of pyrite clusters in the form of rods and irregular lumps in the sediments are interpreted as evidence for hydrothermal activity in the region, related to backarc spreading and associated volcanism. The area holds exciting promise for future surveys. ❑

Fiftieth Independence Day Celebrations at CSIR Laboratories

THE CSIR laboratories/institutes participated with great enthusiasm in the nation-wide celebration of the 'Fiftieth Anniversary of India's Independence'.

For example, the Indian Institute of Chemical Technology (IICT), Hyderabad, participated in the celebrations organized by the Andhra Pradesh Government, through its Tableau on the theme 'Science & Technology for Nation's Progress'.

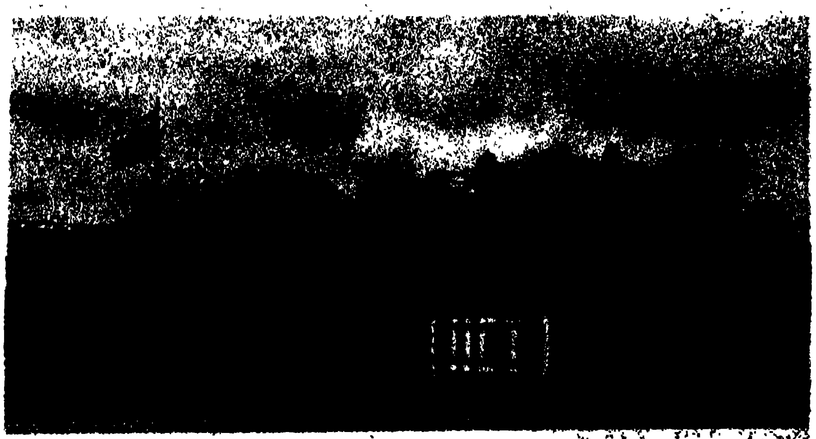
IICT, the origin of which can be traced back to the establishment of Central Laboratories for Scientific & Industrial Research (CLSIR) in 1944 in the erstwhile Hyderabad State, is today geared to develop globally competitive technologies.

With the integration of the Hyderabad State with the Indian Union in 1956, CLSIR came under the aegis of CSIR, and was renamed as Regional Research Laboratory (RRL), and later, in 1989 it was renamed as Indian Institute of Chemical Technology (IICT).

Inaugurating the buildings of CLSIR on 2 January 1954, the first Prime Minister of India Pt Jawaharlal Nehru had said that no country could progress without science, however able the administration might be. The State would no doubt be benefited from the laboratory and so would be the neighbouring areas. Today as we look back on his vision, step by step the institute has helped in the progress regionally and nationally, and is now an internationally recognized institution of R&D. It has developed over 200 technologies in the field of coal, agro-chemicals, drugs, organic chemicals, etc., of which around 150 are in commercial production. Thus the vision has blossomed into reality and the institute continues to carry out its globally competitive scientific pursuits.

At the Central Mining Research Institute (CMRI), Dhanbad, Dr T.N. Singh, Acting Director of the institute unfurled the National flag and took the guard of honour. He paid homage to the myriads of martyrs who laid their lives for the freedom of the country. He recalled with gratitude the courage, dedication and sacrifices of the country's millions of sons and daughters who were instrumental in making India free from the shackles of the British imperialism. In this context, he touched upon the contributions made by Netaji Subhash Chandra Bose, Bhagat Singh, Gandhiji, Jawaharlal Nehru and others.

Dr Singh said. "It is true that we have achieved political independence, but we are yet to gain



IICT's tableau

Dr T.N. Singh, Acting Director, CMRI, delivering his address on the occasion of Fiftieth Independence Day Celebrations at CMRI

true independence in the field of science, economy, industry and various other sectors. It is our bounden duty to preserve the sanctity of the hard-earned freedom. It would be possible only when we can bring self-sufficiency in all facets and save the country from any sort of exploitation and extortion by the developed nations" he continued.

Dr Singh urged the scientists to rededicate themselves in their work to achieve excellence in R&D which is essential for pushing the wheels of progress of the country forward.

He also announced various awards for CMRI Scientists, for good scientific articles and patents, particularly of international standards, and laid the foundation stone of the Golden Jubilee Gate. It was followed by Bana Mahotsav when scores of saplings were planted to keep the environment clean. ❑

CECRI Foundation Day

SET up in 1948, the Central Electrochemical Research Institute (CECRI), Karaikudi, celebrated its Foundation Day on 25 July 1997 at its premises. The occasion also marked the beginning of the year-long Golden Jubilee Year celebrations.

Prof. K. Ramchand, Director, Centre for Air Borne Systems, DRDO, Bangalore, inaugurated the Golden Jubilee Year celebrations and delivered the CECRI Foundation Day lecture. Prof. G.V. Subba Rao, Director, CECRI, presided over the function.

Prof. Subba Rao in his address said since its foundation on 25 July 1948 and its full-fledged operations from 1953, CECRI has made rapid strides in electrochemical science and technology in the country. Over the years, 600 patents have been filed, 178 processes have been de-

Prof. G.V. Subba Rao, Director, CECRI, delivering his presidential address at the inaugural function of the CECRI Foundation Day Celebrations

veloped and 186 sponsored projects, 60 grant-in-aid projects and 256 consultancies have been undertaken. More than 110 processes have been released to 360 licencees for commercial exploitation. Nearly 3800 research papers have been published. Not a mean record in five decades of existence!

CECRI, Prof. Subba Rao continued, is now considered as one of the leading CSIR laboratories and the best institution for Electrochemical Science and Technology in the entire South-East Asia region. The history of CECRI is the history of electrochemistry in India and the future is going to be bright, he added.

The sustained R&D work in the field of Corrosion Science has led to the development of anti-corrosion technology and metal finishing processes. Many finished technologies in use have already started giving healthy feedback. It includes cement polymer coating for rebars and development of instruments for on-line monitoring of corrosion. CECRI has also developed the know-how for many electrochemical metals and alloys of both organic and inorganic materials. A process under which potassium iodate could be used as iodized salt has also been developed. CECRI scientists made a breakthrough in the electroforming technology for rocket engine application, which has been successfully adopted for sub-scale engine on the first C 12 engine thrust chamber, which has been commended by ISRO.

The institute has also entered the global market by transferring technologies — the technology on 'cement polymer coatings' has been licensed to a firm in Sharjah on payment of US $ 40,000.

CECRI has made significant contributions to the transfer of technology to small and big entrepreneurs and to rural areas. With the help and guidance of late Thavathiru Kundrakudi Adigalar and the present His Holiness Ponnambala Adigalar of Kundrakudi Adhinam, CECRI, alongwith VPF, STED Task Force, MEGSAT, CLRI-UNDP, CSMCRI and SSM, has been successful in transfer of many technologies to generate employment and wealth and S&T awareness in Sivagangai district. A colony, Ambedkar Nagar, has been adopted and work is being carried out for the last five years for its sustained development. The above activities are in tune with the general policy of CSIR that the laboratories have societal obligations and must render all possible help to the rural people in and around the area where they are located.

CECRI logo designed by Shri C. Chakkaravarthy, a Scientist of the institute, was released on this occasion by Shri A. Muthukrishnan, Administrative Officer, CECRI, and a cash award of Rs 5000 was presented to Shri Chakkaravarthy by Shri M.R. Radhakantha, Administrative Officer, CECRI.

Delivering the Foundation Day lecture and inaugurating the Golden Jubilee celebrations, Dr K. Ramchand said that DRDO has undertaken research in emerging areas of artificial intelligence and robotics, computational sciences, high-energy physics and systems engineering to achieve self-reliance in vital areas of Defence. With an annual budget of Rs 15,000 million, 50 DRDO laboratories were presently working towards achieving this goal. Highlighting significant contributions made by DRDO in the area of aerospace technology, viz. the Light Combat Aircraft [LCA], Remotely Piloted Vehicle [RPV] and Air-borne Warning and Control Systems [AWACS], he pointed out that the aerospace technology plays a key role in the development of defence systems and weapons platform.

As part of futuristic developmental activities, CABS has taken up the development of conducting polymers with the assistance of CECRI. The study aims at developing conducting polymer for application along with the composites, so that the cabinet for avionics made out of composites could have the conducting property required to provide the electromagnetic shielding.

Dr Ramchand handed over the technology documents on 'Cement Polymer Composite Coating', 'Epoxy Polyurethane Coating' and 'Water Treating Chemicals' to Shri S. Sakthivel of M/s Saibaba Corrosion Technologies, Chennai. The technology document on 'Pin Hole Detector' was handed over to Mr Panneer Selvam, Managing Director, M/s Trans Era Systems [P] Ltd, Chennai.

Dr E. Ramaswamy, Principal Alagappa Chettiar College of Engineering and Technology, Karaikudi, pointed out that total dedication and congenial atmosphere would help the scientists perform better in the building of the nation. His Holiness Ponnambala Adigalar of Kundrakudi wanted the benefits of the new findings to percolate down to the grass-root level. Dr N. Krishna Raj, Head, R&D Group of M/s Tribology India Limited, Chennai, also offered felicitations. Shri R. Palanisamy, Scientist, CECRI, read out the messages received on the occasion, including the one from Dr R.A. Mashelkar, Director General, CSIR. Earlier, Dr A.S. Lakshmanan, Deputy Director, CECRI, welcomed the gathering. Dr M. Raghavan, Deputy Director, CECRI, proposed a vote of thanks. ☐

Industry - Institute Meet at CSIO

AN Industry-Institute meet was held on 20 June 1997 at the Central Scientific Instruments Organisation (CSIO), Chandigarh. It was attended by 62 delegates from industry, academic and R&D institutions. Prof. S. Rame Gowda, Chairman, All India Council for Technical Education (AICTE), New Delhi, was the Chief Guest on the occasion.

Prof. S. Mohan, Director, CSIO, welcomed the Chief Guest and delegates, and explained the importance of this meet and its usefulness to all sectors, viz. industry, academic institutes and the R&D centres.

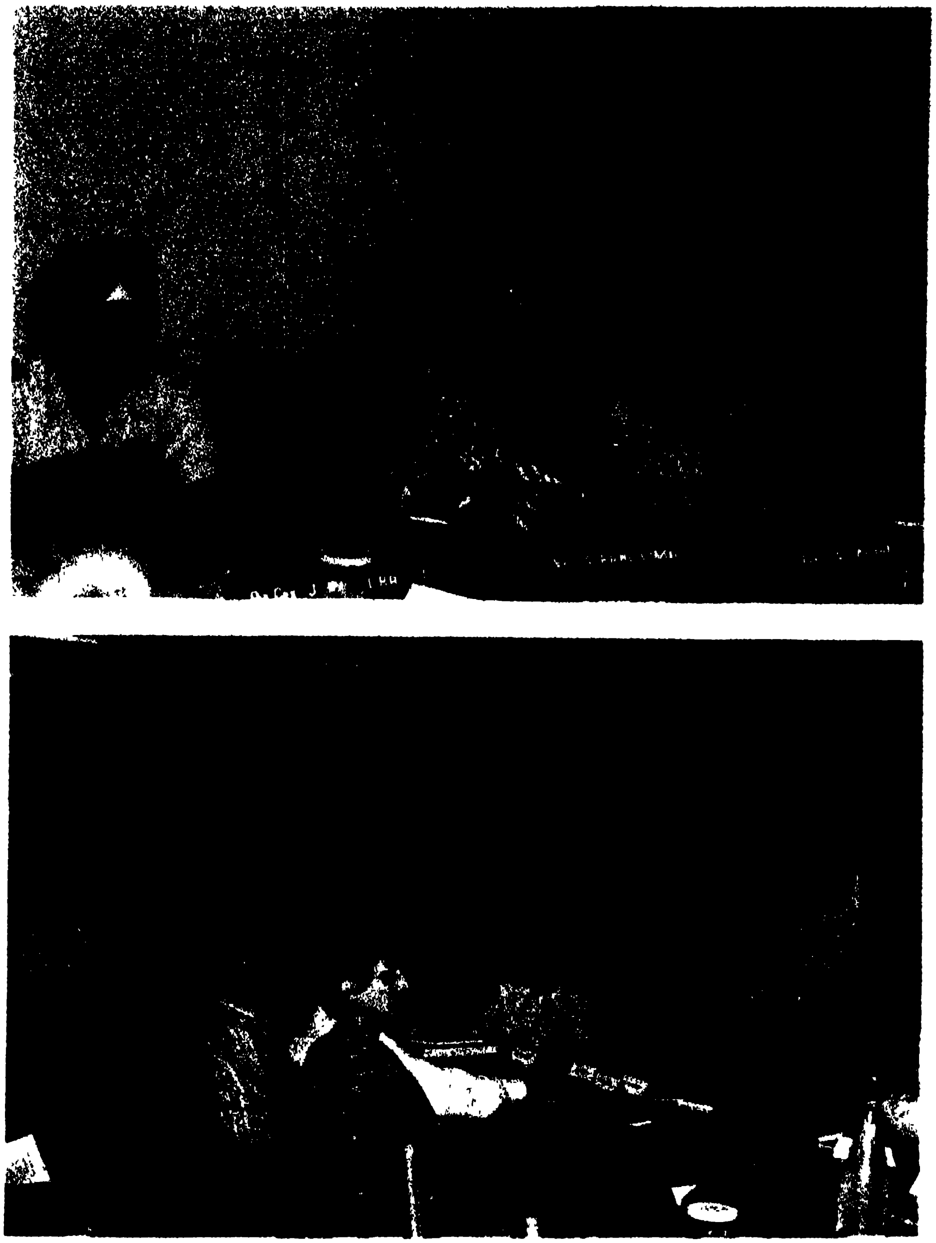
Prof. Rame Gowda, in his address, deliberated on the gap existing between products of educational system and requirements of industry in India. This gap, he said, should be filled in by exposing the students to industrial environment and sharpening their skills. He emphasized the need for producing larger number of working technologists with multi-disciplinary skills.

He further added that as accreditation from AICTE is mandatory for all technical institutions in the country, 20 technical committees have been set up to evaluate these institutes. Assistance from AICTE will be provided to only those colleges which qualify for accreditation, being granted course by course, and the students of these colleges will be preferred in areas of employment and higher education abroad. He informed that AICTE would be organizing an international workshop in February 1998 on accreditation procedures, and invited industrialists to participate in this meet.

Air Cdr. J.S. Kalra, Head of 3BRD Unit in Chandigarh, in his presentation explored the possibilities and means of synergizing academicia, industry and market in order to save time and foreign exchange for maintaining the fleet of helicopters and transport aircraft in his organization. Pointing out that most of the spare parts have to be imported, which is a quite costly and time consuming process, he said, development of technologies by industry, to produce these items in India will not only help the Defence organizations in saving foreign exchange but also in promoting the growth of the industry. He offered to buy back these components/items at a pre-negotiated price and for a particular period taking into consideration the future price escalations too. He assured the industrialists all help and facilities required from anywhere in India, for this mission.

Prof. Anup Singh, Vice-Chancellor, Punjab Technical University, Jalandhar, emphasized the importance of developing quality assurance and communication skills alongwith technical skills. He impressed upon the industrialists to perform their role responsibly in imparting skills of problem analysis and synthesizing techniques during six months' industrial attachment of the students to their units. This will enable the trainees in utilizing their knowledge of science & technology for the benefit of the nation, he added.

Dr Anil Jain, an Ambala-based industrialist, laid stress on confidence building between industry, educational institutions and research laboratories. He strongly desired that a team of technical personnel from college/university may visit the small-scale and tiny units at Ambala at regular intervals, identify the problems of the units and suggest realistic solutions. He also sought assistance from national labs and academic institutions in areas of reverse engineering of instru-



Prof. S. Rame Gowda, Chairman, AICTE, addressing the delegates during Industry-Institute Meet at CSIO. Seated on his *left* is Prof S. Mohan, Director, CSIO and *right*, Air Cdr J.S. Kalra, Head, 3BRD Unit, Chandigarh. The second photo presents a view of the meet in progress.

ments, documentation and prototype testing.

Prof. K.K. Aggarwal, Pro Vice-Chancellor, Guru Jambheshwar University at Hisar, opined that some good test laboratories/centres should be set up in the country and curricula should be developed with future needs of the industry in mind. He also expressed that if a group of industries can collectively set up a college/institute in their area of specialization, it will be quite cost effective and also help in minimizing the problem of industrial attachment of students.

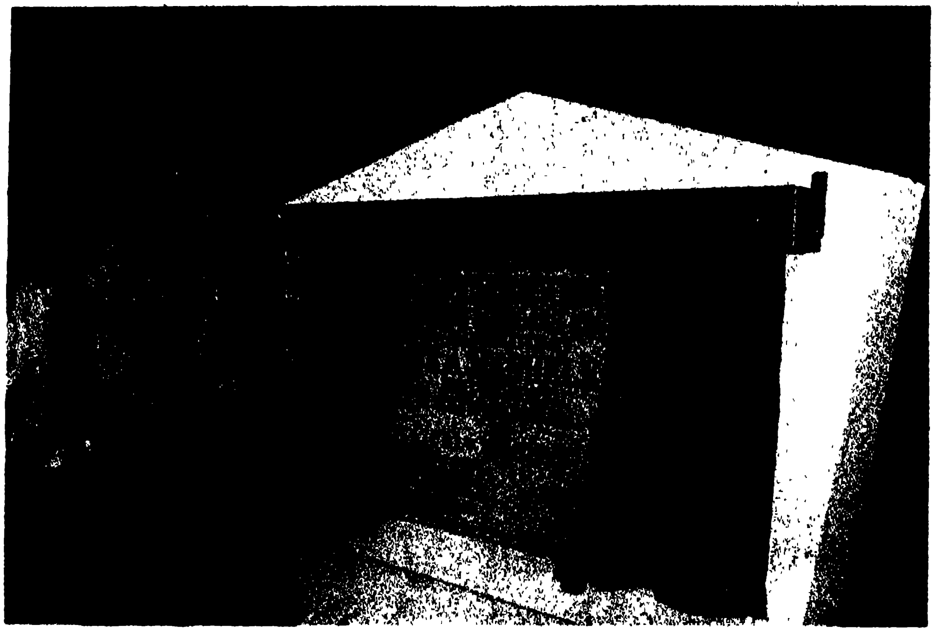
The delegates from industry emphasized the need for: easy access to library facilities in labs./colleges; expeditious and successful completion of projects/jobs undertaken by colleges and laboratories; and bringing out a document indicating source of raw materials, etc. A committee of experts was formed to consider all these aspects. Prof. S. Mohan assured the gathering all the help from CSIO for fulfillment of this mission.

Shri P.S. Malhotra, Principal, Indo-Swiss Training Centre, Chandigarh, proposed a vote of thanks. ☐

Dr Mashelkar compliments NGRI for its excellent performance

ADDRESSING the scientists and staff of the National Geophysical Research Institute (NGRI), Hyderabad, on 26 June 1997, Dr R.A. Mashelkar Director General, CSIR, expressed satisfaction on the overall performance of CSIR laboratories and said that his dream to restore the credibility of CSIR is becoming a reality. He congratulated the scientists of NGRI for enhancing the institute's performance over the last three years and described it as outstanding. He was particularly happy that during 1994-95 and 1996-97 the institute's publications in the SCI journals had almost doubled and the ECF generation had shown an increase from Rs 11.5 million to Rs 111.5 million, which is an indication of high quality science being pursued at the institute. He was also happy to know that NGRI has a Lab reserve of about Rs 30 million. He, however, cautioned that the scientists should not be complacent with these achievements and goaded them to perform better during the coming years to achieve self-financing and high degree of customer satisfaction.

Dr Mashelkar hoped that the targets projected in *VISION 2001*



Dr R.A. Mashelkar, Director General, CSIR, inaugurating the Research Scholars' Hostel of NGRI

document, of which all the 22,000 odd employees of CSIR are co-authors, will be fulfilled. He assured the employees that he was trying his best to improve their working conditions and financial status, and to meet the requirements of the laboratories. Reflecting on the image of CSIR, he expressed his happiness that several industries are taking note of CSIR's presence in the market. The members of Parliamentary Committee on Science and Technology that visited several CSIR laboratories have stressed the need to give full-scale financial support to these institutions. He made a special mention about the Parliamentary Committee views on NGRI, which, he said, were very positive and encouraging, and for this he congratulated the institute.

Dr Mashelkar appreciated the efforts of NGRI in delineating possible oil-bearing Mesozoic sediments under the Deccan volcanic cover in Saurashtra by using integrated geophysical studies and for making similar efforts in other areas. He also saw the salinity meter developed at the institute, to monitor and stop the entry of saline water in the fresh water wells. He also inaugurated the new research scholars hostel having a capacity to accommodate 32 scholars. ❑

Prof. Samir K. Brahmachari takes over as Director of CBT

PROFESSOR Samir K. Brahmachari has assumed charge of the post of Director, Centre for Biochemical Technology (CBT), Delhi, with effect from 11 August 1997. Prior to his present assignment, he was Professor in the Molecular Biophysics Unit at the Indian Institute of Science, Bangalore. ❑

HONOUR AND AWARDS

Dr A. K. Gupta

DR A. K. Gupta, Director, Central Road Research Institute (CRRI), New Delhi, has been honoured by the New York Academy of Sciences (NYAS) for his outstanding work in the area of highway traffic and transportation engineering. This is the highest honour given by NYAS to scientists excelling in their speciality field. This year NYAS is celebrating 180 years of its service to science, technology and society worldwide. It has more than 40 Nobel Laureates as members. It has recognized the work of Dr Gupta, carried out as Professor of Civil Engineering and Chief Coordinator of Centre of Transportation Engineering at University of Roorkee.

In the recent past, the American Biographical Institute had conferred the 'International Sash of Academia' honour on Dr Gupta for his contribution to the field of International Transportation.

Dr M.V. Viswanathan and Dr H.B. Singh

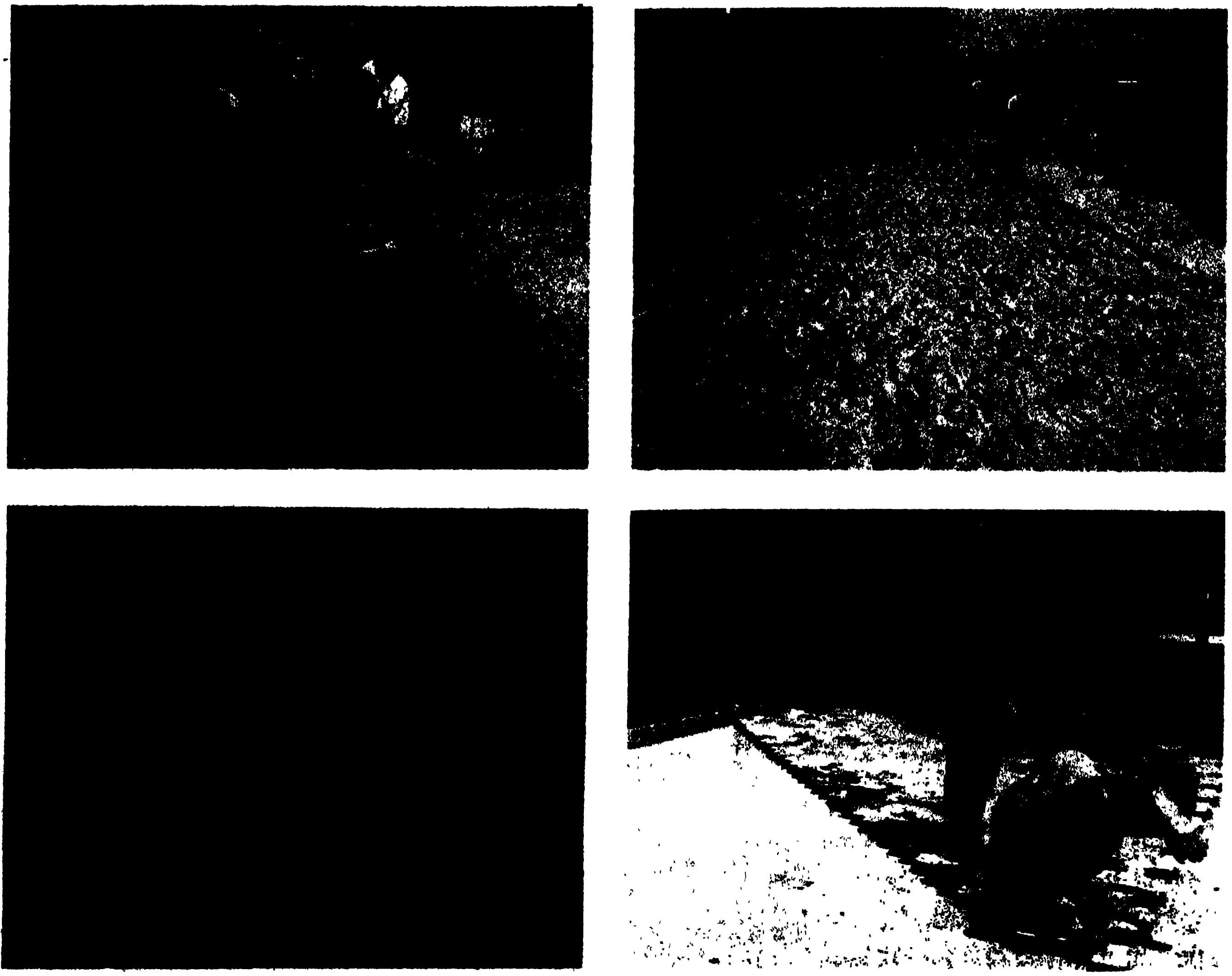
DR M.V. Viswanathan and Dr H.B. Singh, Scientists, Raw Materials Herbarium and Museum, National Institute of Science Communication (NISCOM), New Delhi, have been nominated for the award of D.Sc. degrees by the Senate of the Open International University for Complementary Medicines, Colombo, Sri Lanka, in recognition of their significant achievements in the field of 'Humanitarian Studies'. The degrees will be conferred on them at the World Congress for Integrating Medicines during 27-30 November 1997, at Colombo. ❑

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit
Annual Subscription : Rs. 60
Editors : Dr B.C. Kashyap and Dr C.S. Gupta Editorial Assistant : Neelima Handoo Production : Kaushal Kishore Single Copy : Rs. 3.00
Phone : 5786301 Gram : PUBLIFORM Telex : 031-77271 E-mail: niscom@sirnetd.ernet.in. Fax : 5787062

ISSN 0409-7467

CSIR NEWS

VOL 47 NO 18 30 SEPTEMBER 1997



Clockwise from top right—Jute geotextiles being used in drainage system, and lime-stabilized pond ash for road construction; and laying of ICBP blocks, and mastic asphalt in progress, based on the technologies developed at Central Road Research Institute, New Delhi. Highlights of R&D programmes of the institute are given on page 258

CENTRAL ROAD RESEARCH INSTITUTE, NEW DELHI
R&D Highlights: 1996-97

THE R&D programmes of the Central Road Research Institute (CRRI), New Delhi, are grouped under the following major areas: Geotechnical Engineering, Soil Stabilization and Rural Roads, Flexible Pavements, Rigid Pavements, Bridges, Instrumentation, Traffic and Transportation, Environment & Road Traffic Safety, Pavement Performance Studies, and Highway Planning and Management.

During 1996-97, the institute had in hand 25 major R&D projects, of which six projects were completed. External Cash Flow during the year amounted to Rs 15.278 million. Besides, the institute organized a few international conferences/workshops including the national workshop on 'Jute-based Geotextiles' in association with Indian Jute Mills Association, and the international seminar on 'Natural Disaster Mitigation for Roads' on behalf of G-2 Group of World Road Organization (PIARC), the proceedings of which were compiled and sent to the member countries. The institute has been recognized as the nodal agency for Intelligent Transport System (ITS) for Asia and Pacific Region. A white paper on *CRRI Vision - 2001* has been prepared to boost marketing of its knowledge-base. The major area-wise R&D activities during the year are as follows:

Geotechnical Engineering

To achieve the objective of proper planning, design and management of hill slopes, an Engineering Database on Landslides has been prepared. It contains information about 210 landslides investigated by CRRI and provides information on various aspects of landslide activities.

The technique of reinforced earth retaining wall was advantageously adopted for a section of approach embankment of Okhla Flyover. The construction of retaining wall not only proved to be flexible and faster but also cost-effective.

The laboratory investigations on anchored nails, a new concept in soil nailing technique for stabilization of deep cuts/steep slopes revealed that the anchored nails exhibit a superior shearing resistance as compared to conventional nails. Proportional increase in yield strength with the increase of anchored tip diameter was also studied. Such a technique requires less number of nails compared to conventional nails and is cost effective.

A finite element method has been developed for the design of trench drains. Trench drains are systematic network of rubble drains constructed on slope for increasing its stability by quickly draining out subslope water. The rubble drains are encapsulated in a permeable geotextile. Use of geotextile prevents the finer soil particles to enter into rubble voids which otherwise may render the drain ineffective. The trench drain system consists of a longitudinal interceptor and cross drains at suitable places.

Jute, a lignocellulosic natural fibre, is bio-degradable. Tests were conducted to understand the behaviour of the jute geotextiles in civil engineering applications, e.g. as filteration, reinforcement and separation functions in road construction and ground improvement. These are also used for the control of erosion on the denuded hill slopes. It increases the slope stability by providing check to the surface runoff and enhances the vegetation growth.

Jute geotextile is found useful in road construction between pavement layers when used as separator. It retains the fine soil particles effectively and water is drained through the permeable jute geotextile. It has also been found to act as reinforcement and prevents localized bearing capacity failures resulting from individual stones being forced into the subgrade.

Laboratory investigation of furnace ash for use in road embankments revealed that it is a superior construction material which can be used in road embankment and as a fill material.

Soil Stabilization and Rural Roads

The network planning model, which was developed in this institute earlier, has been modified to optimize the network on cost basis and also to check the distances from three different education level centres. It has the flexibility to be used with different objectives. Construction of test-track with the use of municipal waste as sub-base in three different specifications has been completed.

To explore the possibility of using solid wastes like blast furnace slag, steel slag, granulated slag, flyash, etc., which are produced by steel plants, an experimental test-track was constructed. Attempts were made to formulate specifications to make maximum utilization of different solid wastes.

Under the 'Technology Mission on Utilization & Disposal of Flyash', demonstration stretches using flyash are being constructed in Karnataka and Delhi. In Karnataka, the construction work of demonstration stretch on Raichur-Arshanagi road is nearing completion. A part of WBM layer has been replaced with lime stabilized pond ash in base course. The performance of the above stretch would be monitored for a period of three years.

Investigation of Surat Olpad road revealed that the main reason of road failure was the entry of water into granular overlay laid over old black top surface from shoulders.

Rigid Pavements

Construction of a 200m stretch of roller compacted cement concrete pavement has been completed under a project sponsored by DST, using lean cement flyash concrete as base course and roller compacted cement concrete pavement as wearing course.

Flexible Pavements

R&D activities in the area were directed towards strengthening and improving the roads and airfield pavements. Four projects were completed:

(i) Development of methods, such as Benkleman Beam Deflection method, for evaluating structural capacity of flexible pavement and overlay design of any weak pavement

(ii) Criteria for choice of type of bituminous surface courses under different conditions.

(iii) Maintenance cost study under different conditions.

(iv) Performance evaluation of different paving grade bitumen in various climatic regions of India.

Lean cement flyash concrete being placed as base course for construction of roller compacted cement concrete pavement

Extensive laboratory work on modified binders has been conducted to improve the quality of conventional bitumens. The main advantage of adding ethylene-based co-polymer as modifier in bituminous mixes is easy mixing with aggregates. Other advantages are: higher fatigue life, increase in stability and high tensile strength. Similarly, styrene-butadiene-styrene co-polymer has been found to improve the resistance to deformation at high temperature and flexibility at low temperature to prevent cracking of bituminous surfacings. Rubber modified binder can be used in works as stress absorbing membrane and stress absorbing membrane interlayer for preventing reflective crackings on bituminous surfacings.

The work on some of the following important R&D projects is under progress:

(i) Use of large size aggregates in highway construction to prevent rutting.

(ii) Development of high-strength bituminous mixes.

(iii) Development of suitable bituminous binder using waste hydrocarbon materials.

(iv) Use of rubber/polymer-modified bitumen in road construction.

(v) Use of pavement reinforcing geofabric as interlayer for controlling reflective crackings on bituminous overlays.

A report was submitted to MOST on Research Scheme R-16, which highlights the norms for ordinary repair, periodicity of renewal surfacings based on the data collected for maintenance efforts and expenditure related to actual needs for different types of road surfacings under different traffic, terrain and climatic conditions.

Mastic asphalt has proved to be a suitable surfacing material for traffic intersections and bridge decks to cope with the ever increasing traffic and higher axle loads due to its self-healing property, impervious mass, resistance to deformation under heavy loading and ease in maintenance. The institute has provided mix design for mastic asphalt to various organizations.

Pavement Evaluation

Evaluation of Interlocking Concrete Block Pavement is being done since 1993 in J&K through profile measurements and general observations of defects. The blocks have not suffered any damage. The edge restraints have been retained in their position, thereby ensuring the integrity of the pavement structure. Border Roads Organization is planning to construct pavement sections using the ICBP technique.

ICBP technique has also been used as overlay for rehabilitation of old concrete pavement in the premises of CSIR Hq., New Delhi. Site preparation included installation of drainage facilities and underground utility pipes, realignment of curves, dismantling of brick-lined flower-bed platform, dismantling of old concrete foot path and provision of lean concrete levelling course. Edge restraints were artistically installed using the same concrete blocks selected for paving. Blue colour blocks were predominantly used for paving the driveway with artistic patterns using red colour blocks. Green colour blocks were used to pave the parking area and red colour blocks were used in the porch. The flower-bed platform was reconstructed using the blocks giving a new look to the platform. For smooth changeover from the main road to the driveway, mastic asphalt ramps were got constructed at the entrance and exit gates. Post-construction observation revealed that rain water tends to stagnate at one or two locations. However, no distress of any form has been observed.

A pavement surface deflection database on the identified road sections has been developed. Determination of E values for different component layers for a three-layered pavement structure by using ELMOD has been completed.

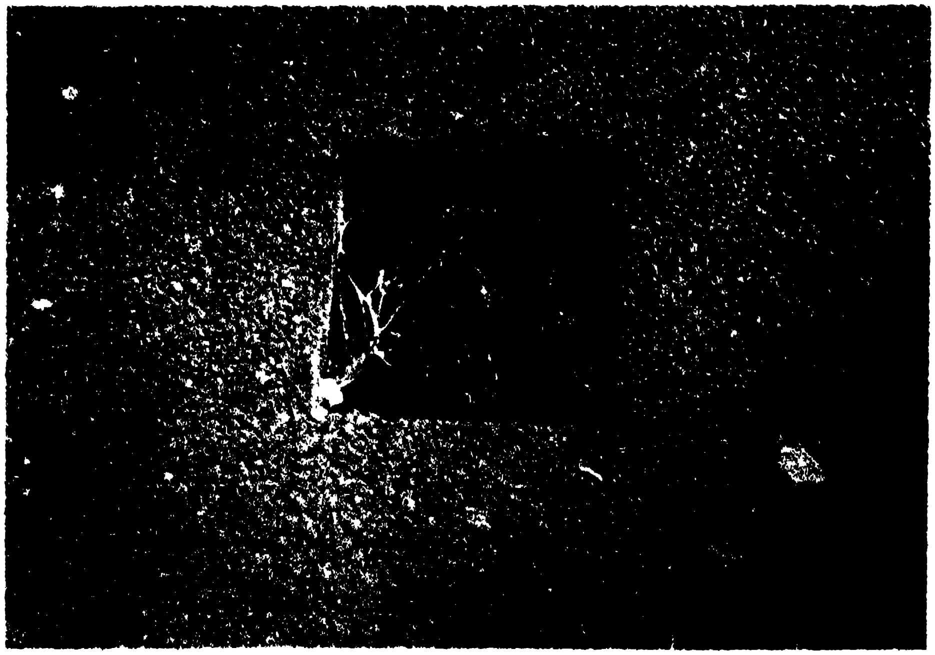
Field measurements on skid resistance of bituminous, cement concrete and mastic asphalt pavements have been completed. Further work on analysis of data is in progress.

The study on functional evaluation of an experimental section on Allahabad-Varanasi Road (NH-2) was undertaken to assess the performance of modified binders with respect to pavement roughness of different test sections, using rubber/polymer in different compositions.

Roughness measurements were undertaken on typical light road sections with the help of Bump Integrator along different wheel paths.

Pavement Performance

The construction of granular sub-base, WBM, Wet Mix Macadam has been completed. Aggregates for bituminous macadam (BM), dense bituminous macadam (DBM), semi-dense bituminous concrete (SDBC) and bituminous concrete (BC) have been identified and work on mix designs completed. The construction of bituminous layers has also been completed. Instruments like pressure cell, strain gauge, moisture cell and temperature sensors have been embedded in seven selected sections at different layers to study performance characteristics of materials under actual loading conditions.



Instrumentation embedded in a bituminous layer to study performance characteristics of materials under actual loading condition

Making use of the large volume of data, which was collected earlier, a study on calibration of Highway Design and Maintenance Standards Model (HDM-III) has been undertaken. Further analysis of the above data is being carried out.

Bridges

The degree of corrosion in concrete structures was measured by the Open Circuit Potential (OCP) method at different time intervals. The OCP measurements indicate that aluminium-rich coating reveals protective behaviour only up to 600 h of spray period, after which its effectiveness decreases. The study further reveals that aluminium-rich alkali silicate coating is ineffective for corrosion protection to rebars.

The deflection of microconcrete model slab with GPRP (Glass Fibre Reinforced Plastics) has been reduced to a considerable extent by increasing the percent area of reinforcement.

Optimum design charts for parallel chord Pratt truss girder bridges have been generated by a software package. These charts depict relationship between span of the bridge and cross sectional properties of various members of trusses.

Traffic and Transportation

Traffic simulation models have been calibrated and validated for narrow and wider roads for plain and rolling terrains. The calibrated models have been tested for their sensitivity by varying the road and traffic parameters. The analysis of model-generated data reveals that densities and speeds are the best indicators of level of service provided by a road section. The model can be employed by highway planners and administrators in taking decisions regarding the augmentation on capacities or enforcing certain regulatory measures like speed and overtaking restrictions. Based on field studies conducted by the institute, a suitable road network and coordinated transportation plan for Nagpur Municipal Area has been prepared.

Vehicular Pollution in Metro Cities of India

The CRRI study has revealed that surface ozone concentration is higher in Delhi during winter months. Initial high levels were observed during morning hours and delayed build up of ozone was observed during evening hours. With a view to suggesting suitable measures to check air pollution, CRRI is creating a broad-based database of emissions; the Delhi Administration is coordinating the project.

The vehicles with two-stroke engines which constitute about two-thirds of the vehicle population were found to be principal contributors in deteriorating the air quality.

Instrumentation

On the basis of test results, it has been found that a standard calibration made in the laboratory between CBR and Impact value holds good for all types of soil, i.e. no separate calibration is required for each type of soil. Automation of surface deflection made by Benkelman Beam for pavement evaluation/overlay design led to direct display of deflections and overlay thickness. With the recent development of a portable device 'Impact Tester', which consists of a compaction hammer equipped with an accelerometer, it has become possible to obtain large number of CBR values in short time. The hammer measures the strength of soil subgrade through dynamic impact value. The know-how has already been licensed to one party for commercial manufacture.

Dissemination of R&D Results — Preparation of a Comprehensive Document on CRRI Publications

The institute disseminates information on R&D products through its various training programmes. Twelve refresher courses were conducted during the year for in-service highway and transportation engineers working in various organizations.

Since 1948, this institute has published about 3000 research and technical papers in different areas of specialization. Compilation of a comprehensive document on CRRI publications (1948 to 1995) with complete bibliographic details including brief abstracts, author and retrieval term indices was completed during 1996. This document, which involved intensive labour with extensive data input, provides an easy access to highway and transport information, thereby enhancing the scope of research and development activities. Ready and consolidated information contained in this document will provide awareness about CRRI expertise and assist users in suggesting or sponsoring useful R&D projects for solving existing and anticipated problems.

Besides preparation of several technical and the annual reports, a brochure on 'Prof. S.R.Mehra Library' was also prepared bringing out various services of the library. ❑

NAL celebrates Foundation Day

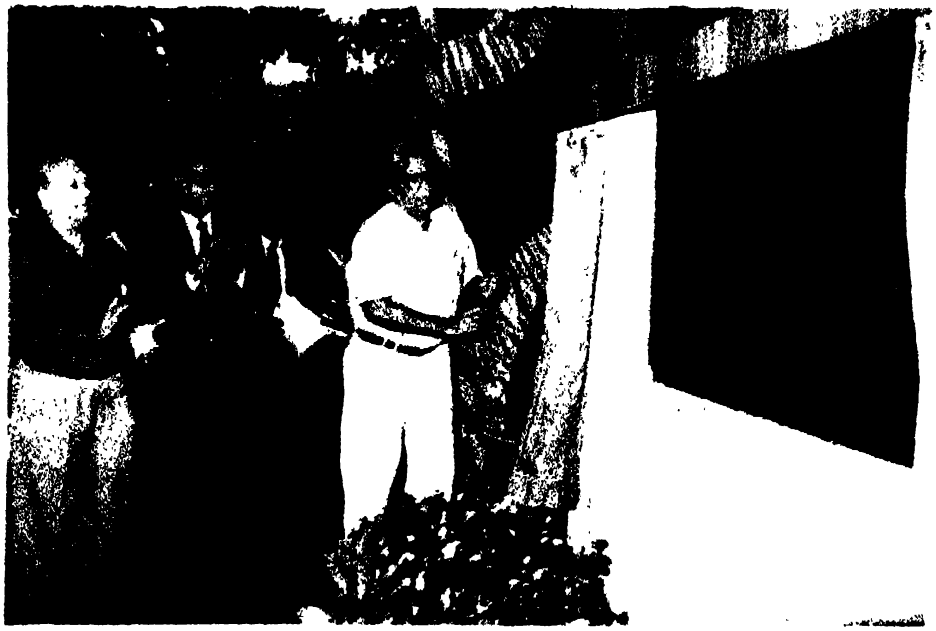
THE National Aerospace Laboratories (NAL) (set up in Delhi on 1 June 1959; shifted to Bangalore on 1 March 1960) celebrated its Foundation Day this year on 18 July. Prof. Y.K. Alagh, Minister of State for Science & Technology and Power and Vice President, CSIR, was the Chief Guest. He delivered the NAL Foundation Day lecture and also dedicated the Wind Tunnel Centre to the memory of Dr P. Nilakantan, NAL's first Director and architect of the laboratory's wind tunnel projects.

Another highlight of the function was the special programme to honour chairmen of the NAL's Research Councils: Prof. S. Dhawan and Prof. U.R. Rao, and the four former Directors: Dr P. Nilakantan, Dr S.R. Valluri, Prof. R. Narasimha and Dr K.N. Raju. Awards were also presented to the NAL scientists and staff members for their meritorious contributions.

Prof. Y.K. Alagh, Minister of State for Science & Technology and Power, and Vice President, CSIR, delivering his address during Foundation Day Celebrations of NAL

The celebrations began in the morning at the Belur Campus with the function to dedicate the Wind Tunnel Centre to the memory of Dr Nilakantan. Dr T.S. Prahlad, Director, NAL, welcomed the gathering, which included Dr Nilakantan's son, daughter, brother and a host of other relatives, and paid a rich tribute to the vision and commitment of Dr Nilakantan. Prof. Alagh then unveiled a plaque to formally rename NAL's Wind Tunnel Centre as the Nilakantan Wind Tunnel Centre and released a special booklet recounting the story of NAL's wind tunnel. Speaking on the occasion, Prof. Alagh said that it was a "lovely occasion" when NAL scientists and friends had gathered to pay a tribute to a remarkable scientist and engineer. "Dr Nilakantan must have been an extraordinary individual; you cannot be a normal person if you are to dream the dreams of Dr Nilakantan", he said.

Later, Prof. Alagh delivered the Eleventh NAL Foundation Day Lecture in the overflowing Systems Auditorium. Dr Prahlad made a brief presentation on NAL's programmes and plans. Prof. U.R. Rao presided over the function. Prof. Alagh's lecture was followed by the presentation of citations/awards.



Prof. Y.K. Alagh unveiling the plaque to rename NAL's Wind Tunnel Centre as the Nilakantan Wind Tunnel Centre

CITATIONS

Prof. Satish Dhawan

Professor Satish Dhawan has moulded the development of science and technology in India for half a century. As Chairman, Space Commission and Secretary, Department of Space, Professor Dhawan led the Indian space programme to an astonishing state of maturity. In doing so he provided a model for the country on how to define, formulate and organize high technology projects, and deliver sophisticated products within stipulated time frames. As Director, Indian Institute of Science, Professor Dhawan led the Indian scientific community to newer heights of success, achievement and eminence.

NAL is singularly fortunate to obtain Professor Dhawan's advice, guidance and affection for nearly four decades. He was a member of NAL's Executive Council since its inception in 1963 and his formal association with NAL continued till he stepped down as Chairman, Research Council, in 1994. Professor Dhawan's advice to NAL was always marked by scrupulous objectivity and a deep concern for its possible social relevance to the country.

As NAL completes 38 years of existence, all of us at NAL take pride in saluting one of the truly great builders of modern India.

Prof. U.R. Rao

As Chairman, Space Commission and Secretary, Department of Space, Professor Udipi Ramachandra Rao imparted unprecedented acceleration to the development of satellite and launch vehicle technologies in India. He worked tirelessly to utilize the benefits of space technology for the welfare of the country. He masterminded the INSAT programme which triggered off India's information revolution. India's esteem in the international space community also soared to great heights under Professor Rao's dynamic leadership.

Professor Rao has had a long and fruitful association spanning over two decades with NAL, and as Chairman of NAL's Research Council he continues to play a vital role in guiding the destiny of these Laboratories.

NAL has great pleasure in acknowledging the monumental contributions of this remarkable individual. Professor Rao not only gave our nation its satellites — he also gave us our pride.

Dr S.R. Valluri

Dr Sitaram Rao Valluri was a leading aeronautical consultant in USA, with a promising and prosperous career ahead of him, when he took a conscious decision to give it all up for the sake of this country. As Director, National Aeronautical Laboratory for an incredible 19 years, Dr Valluri contributed his best years to the development of India's premier aeronautical establishment. Building on the strong foundation created by Dr Nilakantan, Dr Valluri transformed NAL into a potent and remarkable force in Indian aeronautics, making it one of the country's best high science high technology laboratories with allround capability in every aeronautical discipline.

As the first Director-General of Aeronautical Development Agency, Dr Valluri laid the strong foundations required for the successful design and development of India's Light Combat Aircraft.

As we complete 38 years of existence, all of us at NAL gratefully acknowledge the contributions of this indomitable visionary, unwavering patriot and crusading colossus.

Prof. R. Narasimha

As a researcher at Indian Institute of Science, Caltech and Cambridge, Professor Roddam Narasimha has made outstanding contributions to fluid mechanics, aerospace engineering and atmospheric sciences. As a thinker and teacher, Professor Narasimha has always pointed towards something new and exciting, be it in technology forecasting, advanced computing, engineering education or the design of a new fighter aircraft.

As Director, NAL, from 1984 to 1993, Professor Narasimha transformed an already excellent Laboratory into superb, selfconfident and effective R&D Laboratories making their mark in civil aviation, parallel processing, aerospace electronics, surface technologies and computational fluid dynamics. In doing so he also demonstrated how a gifted scientist, engineer and teacher can become a very effective administrator and organizer, providing visionary leadership to every major aerospace programme in the country.

On the occasion of its 38th aniversary, all of us at NAL are delighted to greet one of the country's most creative scientists — who also happens to be a truly cultured person and a much-loved leader and friend.

Dr K. N. Raju

Dr K. Keshava Narayana Raju is one of India's best aeronautical scientists and engineers. In a glittering career spanning nearly four decades, Dr Raju has made remarkable contributions to practically every facet of aerospace science and technology. He led aircraft fatigue and fracture activity at NAL and was the principal architect of the full-scale fatigue testing facility. As leader of the CFC National team, he successfully undertook the responsibility to design, develop and fabricate carbon fibre composite wings for the Light Combat Aircraft.

Dr Raju capped an outstanding career at NAL, which began when Dr Nilakantan invited him to join the laboratory in 1960, by becoming its fourth Director in 1993. As Director he provided extraordinary momentum to NAL's contributions to national aerospace programmes even as the Laboratories' revenues soared to unprecedented heights.

It is with special pleasure that NAL honours Dr Raju — not just for his outstanding leadership and achievement, but also for his loyalty, dedication and endearing human qualities.

Foundation Day Awards to Staff

Young Scientists of the Year (cash award of Rs 10,000 to be shared)

Mr A.A. Pashilkar, Flight Mechanics & Control Division, for 'LCA landing gear and control surface actuator modelling and contribution to LCA control law design studies'

Dr Rama Govindarajan, Computational & Theoretical Fluid Dynamics Division, for 'Fundamental contributions to the theory of stability of spatially developing flows'.

Technical Support (cash award of Rs 3000)

Mr R. Veerapathiran, Horticulture Section, for 'Excellent effort to make the NAL campuses beautiful, green and clean'.

Administrative Support (cash award of Rs 3000)

Mr K. Purushothaman, Administration, for 'Excellent support to scrutinize, clear and sequentially arrange forty years of old house-keeping records within a short period'.

Awards for Outstanding Performance

Mr Shyam Chetty, Flight Mechanics & Control Division, for 'Leadership role in the design of LCA control laws and its assessment using the VISTA in-flight simulator in USA'.

Mr Rajan Kumar, NTAF, for 'Notable and innovative contributions to model instrumentation and wind tunnel testing of launch vehicle and missile models at 1.2m trisonic tunnel'.

Mr M. R. Ramamurthy, D. Sundararajan, S. Raja, Shashikala Rajappa, Annamma Samuel and S. Janarthanam, Structures Division, for 'Detailed experimental and analytical studies leading to the successful aeroelastic testing of LCA wing and GSLV models'.

Mr N. N. Murthy, Mr S. J. Muralidhar, Mr K. G. Venkatanarayana and Mr C. Ramesh, Aerospace Electronics & Systems Division, for 'Successful development and installation of a PC-based centralized flight safety monitoring system for Indian Airlines'.

Mr Mohamed Aslam, Technical Secretariat, for 'Notable contributions to business development and technology marketing in the course of a long and fruitful career at NAL'.

Mr B. Nondappa Naik and Mr M. Govindan Kutty, Structures Division, for 'Outstanding support in the development of the main landing gear door for LCA, using novel composite tooling concepts'.

Ms T. R. Subbalakshmi, Information Centre for Aerospace Science and Technology (ICAST), for 'Valuable support in library automation projects and cheerful disposition in search and reference services'.

Mr S. Muniyappa, Mr Nallaiah and Mr G. H. Siddappa, Horticulture Section, for 'Dedicated and diligent efforts to maintain a beautiful and picturesque NAL campus'.

Mr B. R. Sridhara, Mr J. Suresh and Mr Munirappa, Cash Section, for 'Commendable support in computerizing the Cash Section and meticulous disbursal of cash to staff members'.

Mr P. S. R. Murthy, for 'Remarkable resolve and novel initiatives to implement the official language policy at NAL'.

Mr M. Prabhakaran, Mr S. L. Narasimha Murthy, Ms B. S. Pankaja, Mr B. N. Ramakrishna, Mr K. Somashekara, Assessment Section, for 'Excellent management and efficient operations to ensure timely completion of all assessment procedures'.

Mr L. Pathiappa, NTAF, for 'Meticulous maintenance of files, imaginative drafting of official letters and exemplary personal conduct in running the NTAF office'. ❑

Dr P. Nilakantan — The Visionary, and NAL's Wind Tunnel Centre

NAL's Wind Tunnel Centre was set up as a result of the vision, commitment and untiring efforts of NAL's first Director, Dr P. Nilakantan (1910-1964). Nilakantan was impulsive, volatile, brilliant and erudite; he was also a great patriot. "My life's work should be the establishment of a first rate facility or institution for my country", he used to say.

Nilakantan eventually got the opportunity to fulfil this dream when he was invited by CSIR to start the National Aeronautical Laboratory in 1959 with the "setting up of a transonic/supersonic wind tunnel at Bangalore as its first objective". It was a mandate which would have severely tested the finest engineer of the time. Starting with a clean slate, Nilakantan was being asked to deliver one of the best wind tunnels in the world! He all but achieved this miracle in his five years at NAL. Sadly, he did not live to see the fruits of his labour; following a heart attack, he died at the Coimbatore Government Hospital a day before he would have turned 54 years old.

But Nilakantan's legacy endures. Thirty-three years after his death and 30 years after its commissioning, the 1.2m × 1.2m trisonic wind tunnel is still the jewel in the NAL crown. Day after day, blowdown after blowdown, this first rate facility continues to serve the country. Just as Nilakantan would have wanted it to.

How did Nilakantan do it? Essentially by working with the passion of a man possessed. He was always the first to arrive at the Lab, and the last to leave. One of the secrets of his success was his well-honed engineering sense. NAL's tradition of deep involvement in design and development was established by Nilakantan; and to this day this is what makes NAL unique. As a practising engineer, Nilakantan also laid great emphasis on experiments. He was very severe on colleagues who wore terylene shirts and did not get their hands soiled. He was also a great motivator and team builder. His erstwhile juniors (now very successful aerospace scientists and engineers themselves) say that it was an unforgettable experience to work for Nilakantan: "He could be occasionally harsh and demanding, but it was a pleasure to work for him, and earn the rare compliment from him".

Warm Accolades

".. (Nilakantan) is to be commended for his superior work, fine character and pleasant personality. It will be most difficult at this time to obtain the services of another engineer capable of the advanced mathematical work which he has been doing.." —**K.F. Ridley, Chief Engineer, Hughes Aircraft Co., California, USA in 1944.**

".. (Nilakantan is) one of the few very best of the physicists who worked in my laboratory during my active scientific career of over 30 years. His personal qualities are of the highest type.." — **Sir C.V. Raman in 1945.**

".. The Aeronautical Society of India was largely the result of Nilakantan's untiring efforts and sound organisation work.." — **Sir N.C. Ghosh, Founder-President of Aeronautical Society of India in 1951.**

Nilakantan worked extremely hard on documentation; before freezing the technical specifications for the NAL wind tunnels, he prepared nearly 50 drafts, and must have personally scrutinized and reviewed many thousands of pages.

Finally, Nilakantan was extremely impatient; as he perhaps had to be. When work on the wind tunnel began at Belur, one of the first tasks was to level the ground. "How long will it take?", Nilakantan asked a colleague. "About 10 months", was the reply. "I can't wait for more than a week", Nilakantan said even as he picked up the telephone to call the Army Garrison Engineer. The Army bulldozers levelled the ground in exactly three days!

The Genesis

NAL's wind tunnel project is intimately linked to the birth of NAL itself. In 1955-56, Nilakantan (then with the Ministry of Defence) submitted a 50-page report to CSIR, containing recommendations on the organization of aeronautical R&D in India. This report, remarkable for its clairvoyance and breadth of coverage, proved to be the genesis both of NAL and its wind tunnel centre. The report received a very favourable response from CSIR and triggered off a long sequence of events during 1956-58, leading eventually to the creation of NAL in 1959 with the mandate to build, on high priority, a transonic/supersonic wind tunnel. Although it took nearly three years for NAL and its wind tunnel project to formally take off, the intervening time period was useful to carry out a large number of exploratory studies, and to freeze critical engineering specifications. Some of the major decisions taken during the period were:

- Opt for a 'blowdown type' wind tunnel; even though the original proposal envisaged a continuous flow closed circuit tunnel. Following this decision, preliminary design studies and pilot scale experiments were started in a big way in 1958 itself at the small blowdown tunnel of the Indian Institute of Science under Prof. S. Dhawan.
- Design the air supply and storage facility as a unitary complex which can serve a large number of blowdown wind tunnels and test rigs with a high degree of flexibility.
- Build a 4 ft × 4 ft trisonic wind tunnel with a Mach number range of 0.5-4.0 and a storage pressure of 150 psig.

The choice of a 4 ft test section (the design teams briefly toyed with the idea of a 5 ft test section) and the Mach number range was probably dictated by the likely testing demands, energy requirements and available funding— and the fact that almost all big tunnels at that time had the same size and range. The 150 psig pressure level was chosen because the storage system could be manufactured in India itself, and a significant foreign exchange outflow could be avoided.

Looking back, one marvels at the engineering judgement and vision which marked each of these decisions. For example, one wonders if there was even a murmur of a launch vehicle programme around 1960 which might have prompted Nilakantan and his colleagues to choose a supersonic range up to Mach 4.0. But, by serendipity or otherwise, they got it absolutely right! The 4 ft tunnel went on to become an invaluable design tool for India's launch vehicle programmes.

Finally, why was Belur chosen as the location? The availability of an adequate supply of water from the adjoining Bellandur Lake was one major reason. But Nilakantan also pointed out that the access to the HAL runway on one side would help future flight activity programmes, while the access to the lake on the other side offered the prospect of amphibious flight research.

The foundation stone for the Belur wind tunnel complex was formally laid by Prof. M. S. Thacker, DG-CSIR, on 2 July 1961. NAL's wind tunnel campaign had begun.

The Campaign

The project to build a 4 ft trisonic wind tunnel on an *ab initio* basis would be considered a mammoth and unusually complex R&D task even today. Forty years ago, it must have seemed like an impossible engineering dream. The real greatness of Nilakantan lies in the fact that he converted this dream into an outstanding engineering facility.

The campaign involved the selection and acquisition of land; creation of workshop and laboratory facilities; civil construction to house the facilities; pilot studies to establish design criteria; setting up of associated mechanical and electrical plants; locating, selecting and developing engineering subcontractors; recruiting the best available scientists and giving them high quality training. But, more than anything else, the campaign required the highest skills in project management.

What was Nilakantan's formula for success? As a manager, he worked with great energy and devotion (he once chaired 21 meetings on one day). He was also a hard taskmaster who believed in loading his staff " to 300% of their capacity". As an engineer, he was an ardent advocate of the virtues of first principles. When approached with a design idea, he would first say "make a drawing"; when he was shown the drawing, he would say: "now build a scaled down engineering model".

Indeed, Nilakantan's core strategy for the wind tunnel project was based on this abiding faith in the laws of similitude. The project therefore began by designing and assembling a 2 inch × 2 inch intermittent blowdown wind tunnel with the associated compressor system. This tunnel, ready by 1961-62, was used extensively for several preliminary and basic investigations in wind tunnel design. Next came the 1 ft × 1 ft tunnel which too proved to be a very valuable platform for aerodynamic and structural studies, and in the development of control and instrumentation systems for larger tunnels. So when work on the larger 4 ft tunnel began, the NAL team led by Dr D.M. Rao was fully prepared to face the big challenge.

The 4 ft tunnel project started gaining real momentum only in 1963. Detailed specifications, based on available literature and the first-hand international experience of NAL scientists, were drawn up. Sizing of various components, performance characteristics, control requirements to maintain steady test pressure, automatic sequencing of tunnel operations, safety interlocks, emergency shutdown, etc. were worked out to the last detail. An international enquiry was then sent for the supply, erection and commissioning of the 4 ft trisonic tunnel, meeting these stipulations.

The response from Canadian Vickers to the enquiry was finally accepted; a decision to some measure influenced by the fact that an attractive Canadian loan offer accompanied the package. Nilankantan had a few initial reservations about Canadian Vickers, but he need not have worried. The arrangement worked very well, except for a minor project delay of about a year.

After three exhilarating years of engineering, the 4 ft trisonic tunnel was ready. When the roar of its first blowdown reverberated across the Belur campus and Bellandur Lake on 29 May 1967, it was a very special moment. Sadly, Nilakantan was no more; he would have been overjoyed that NAL had fulfilled its promise to the nation.

The Legacy

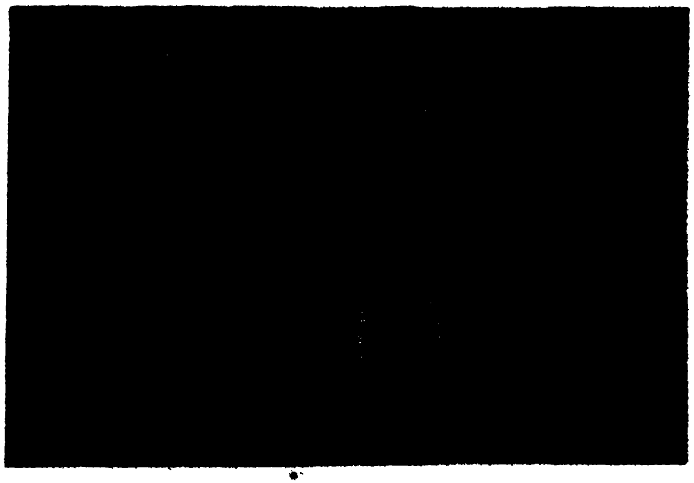
Thirty years after its first blowdown, the 1.2 m × 1.2 m trisonic wind tunnel continues its splendid run. The tunnel has now completed over 23,000 blowdowns and promises to go on and on. No wonder, Prof. R. Narasimha calls it "probably the best blowdown tunnel in the whole world".

There are good reasons why NAL's 1.2 m trisonic tunnel might indeed be the best of its kind in the world. As NAL scientists explain: "We are not likely to have a continuous flow tunnel in India because of the power situation and high cost; realizing this, we have carried out experiments here which no one would dream of attempting in blowdown tunnels!". For example, NAL has successfully undertaken tests for launch vehicle multi-booster separation studies, dynamic stability, flutter and heat transfer studies in its blowdown tunnel; everywhere else in the world such tests are normally carried out in a continuous flow tunnel.

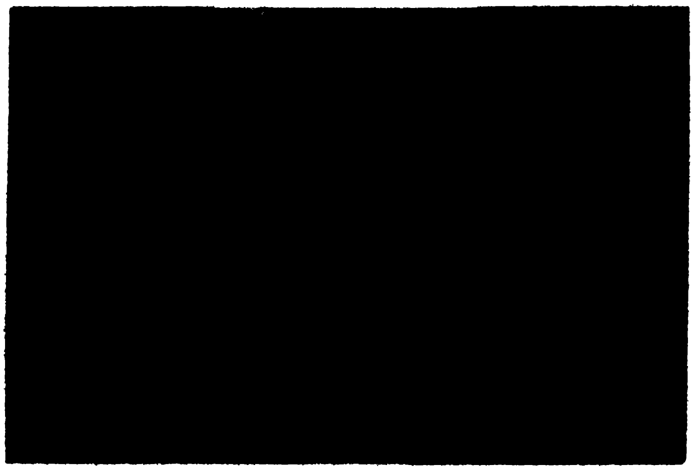
Over the years, there have been several instances of magical experimentation. In 1976, there was a requirement to study the trajectory of a store separating from a MiG-21 aircraft. The test was to be carried out at ONERA's wind tunnel in France. But, for some reason, ONERA did not agree to put the MiG model in its wind tunnel. ONERA's refusal kindled a new resolve, and within four months, NAL scientists developed techniques to successfully carry out the wind tunnel test at NAL's 1.2 m tunnel. This success

[illegible]

- [illegible] commissioning of a 0.6 m high speed tunnel with associated systems
- Design and fabrication of complex wind tunnel models and test rigs
- Development of semi-captive trajectory simulation technique
- Extension of semi-captive technique to determine trajectories of multiple strap-on boosters separating from launch vehicles
- Development of forced-oscillation rig for dynamic derivative measurements
- Commissioning of a captive trajectory system for study of release characteristics of an aircraft store
- Development of aircraft intake testing techniques with associated instrumentation and control systems.

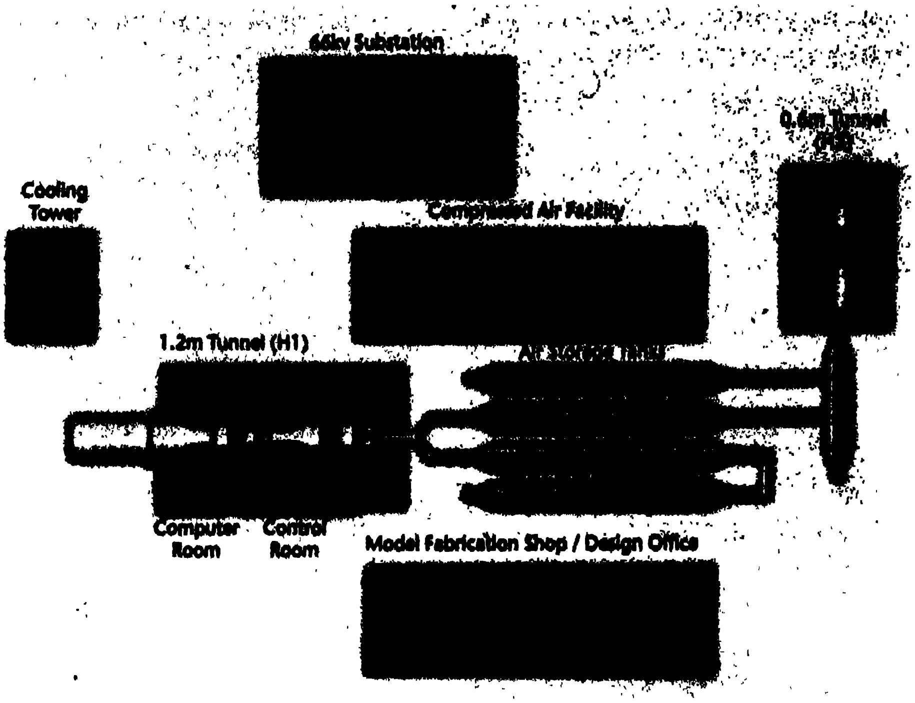


Flow visualization



1/7 Scale air intake model being tested

eventually led to the development of the innovative semi-captive trajectory simulation technique. More recently (around 1990), NAL carried out a series of remarkable wind tunnel tests for air intake studies on the Light Combat Aircraft (LCA); this involved the design and fabrication of a composite air intake model, sophisticated instrumentation and realtime testing to study pressure recovery and buzz characteristics.



An objective assessment of the performance of the NAL wind tunnels would point to three major achievements:

- Very significant support to all national aerospace programmes (aircraft, missiles and launch vehicles)
- Development of novel test techniques for blowdown tunnels
- Design and fabrication of sophisticated models and balances.

One of the most remarkable features of NAL's 1.2 m trisonic tunnel is that it has been continually busy for the last three decades! Better still, its productivity has been increasing during these years. For example, in the early 1970's, NAL's tunnels could generate about 7000 to 10,000 data points every year. Twenty years later, this figure rose to 120,000 data points per year.

The tunnel that Nilakantan set out to build has therefore come a long way. Every aerospace vehicle built in the country has graduated out of NAL's 1.2 m trisonic tunnel. It is truly a wondrous legacy that Nilakantan has left behind for Indian aerospace. ❑

Specifications of 1.2 m Trisonic Tunnel

- Working section: 1.2 m × 1.2 m
- Operation: Intermittent blowdown
- Test duration: 30 seconds (typical)
- Mach number range: 0.2 to 4.0
- Transonic insert: Perforated walls, 60° inclined holes at top and bottom with 6% open area, normal holes at side with 20% open area
- Stagnation pressure: 1.5 to 8.0 bar
- Reynolds number: 8×10^6 to 60×10^6 per metre
- Model incidence: -15° to +27°, continuous and step mode
- Model roll angle: 0° to 360°
- Instrumentation: Strain gauge balances, pressure transducers, electronically scanned pressure measuring systems, thermo-couples
- Special controls: Transonic Mach number control, transonic Mach number sweep and pressure sweep.

Air Compressor System

- Two centrifugal compressors, each driven by a 2100 kW induction motor
- Delivery pressure: 12 bar
- Volume flow: $280 m^3$/min per compressor
- Moisture content of air: 0.0001 kg/kg of dry air
- Capacity of air receiver system: $4 \times 700 m^3$

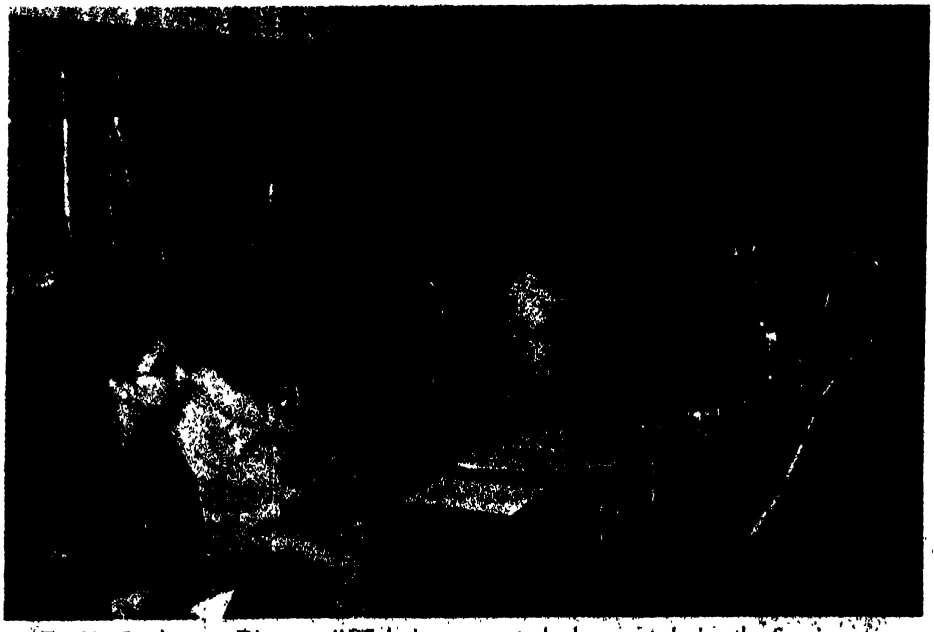
Seminars

Modern Trends in Industrial Toxicology for New Bioactive Molecules

THE Indian Institute of Chemical Technology (IICT), Hyderabad, hosted a one-day seminar on 'Modern trends in industrial toxicology for new bioactive molecules' on 30 June 1997. It was organized on the occasion of superannuation of Dr M. Mustafa Ali Khan, a noted scientist from the toxicology section of the institute.

The seminar focussed on the need of novel *in vitro* methods of toxicological evaluations. These are simple methods utilizing cell and tissue culture techniques instead of animal models. Indian pesticide industry's growth rate is one of the highest in the world. The turnover in 1993 of the pesticide industry is estimated to be nearly Rs 13,500 million. Thus, with more xenobiotics in the environment, it is very important to take stock of the toxicological trend of the chemicals. For registration of pesticides in the country, a number of toxicological studies need to be carried out.

IICT Director Dr K.V. Raghavan welcomed the guests and delegates and emphasized the need to take stock of the requirement for novel methods of bio-evaluations and toxicological testing of industrial chemicals. He said that the need for this seminar at this juncture was important to help us define the dimensions of the problems of new bio-active molecules; and a gathering of this kind would take us a step forward in our understanding of the subject of Industrial Toxicology. The Chief Guest on the occasion, Prof. H.L. Bami, Consulting Forensic Scientist, New Delhi, in his inaugural address highlighted the pesticide pollution problems and the need for improving the evaluation methods in toxicology. He listed out the pesticides banned in our country which include popular names like endrin, chlordane, heptachlor, BHC, toxaphene, ethyl parathion, paraquat, nitrofen, etc. This ban has led to the production of several new chemicals for application on crops. The fate of other new pesticides is now under review and toxicity studies will reveal the safety and hazards of these pesticides. He also touched upon the regulatory procedures for registration of pesticides by the Central Insecticides Board, and the role of government in quality control.



Dr K.V. Raghavan, Director, IICT, being presented a bouquet during the Seminar on 'Modern Trends in Industrial Toxicology for New Bioactive Molecules'

Dr P.K. Seth, Director, Indian Toxicology Research Centre (ITRC), Lucknow, in his keynote address listed out the various assays for evaluating the toxicological testing. An important assay was the evaluation for mutagenecity and carcinogenecity. He emphasized the need to develop suitable diagnostic tests to suggest remedial or preventive measures. Epidemiological surveys and bioefficacy of the industrial and pesticidal molecules is essential.

Prof. Y.R. Ahuja, Emeritus Scientist, highlighted some useful bioassay like comet assay, sister chromatic exchange, micronucleus assay, etc., for evaluating the DNA damage by the harmful chemicals.

Dr Ramesh Bhatt of NIN dealt with the risk analysis and safety evaluation of new bio-active molecules.

Dr Mustafa Ali Khan spoke on his experience in Pesticide Toxicology and importance of the study of inhalation toxicity which could cause enormous damage to lungs, eyes, skin, etc.

Finally, Dr Kaiser Jamil, Deputy Director and Convener of the seminar, highlighted the fate of chemicals in the environment and emphasized the need for a shift to 'Biologicals' which are environmentally safe and biodegradable. *Neem* products and bio-pesticides may come to stay with us, since there exists a global demand for 'soft' pesticides and bio-control agents. These are largely free from adverse side effects on man, domestic and other animals, etc., and are largely pollution-free for the environment.

The seminar addressed the issues of the three main branches of Toxicological Sciences, viz. Forensic Toxicology, Economic Toxicology and Environmental Toxicology. The Toxicology Unit at IICT is geared to take up these studies on non-target organisms. Dr Paramjit Grover, a Scientist of the Toxicology Unit, proposed a vote of thanks. ❑

National Conference on Electrochemical Engineering & Technology

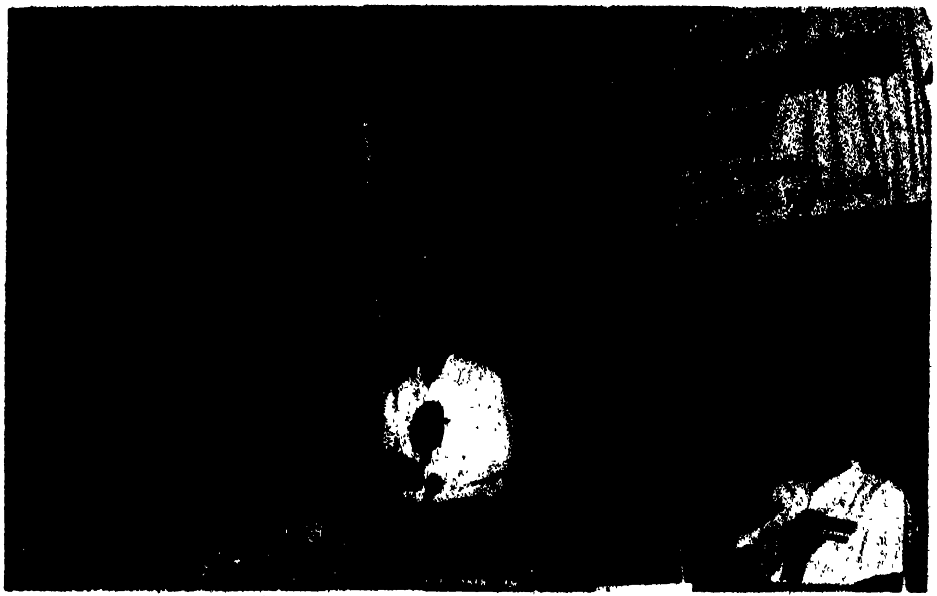
A national conference on Electrochemical Engineering & Technology was organized by Central Electrochemical Research Institute (CECRI) and SAEST, Karaikudi, at Chennai on 27-28 June 1997. The conference was co-sponsored by M/s Grasim Industries Ltd, Mumbai; M/s UDHE India Ltd, Mumbai; M/s E.I. Dupont India Pvt Ltd, New Delhi; and supported by CSIR and DST.

Dr T. Ramasami, Director, Central Leather Research Institute, Chennai, inaugurated the conference. Prof. T.R. Ramachandran, Director, Jawaharlal Nehru Aluminium R&D Centre, Nagpur, presided over the function and released the souvenir brought out on the occasion. Shri S. Krishnamurthi, Secretary, SAEST, introduced the delegates. Shri B. Satyanandam, Head, SILEU, CECRI, welcomed the delegates and Dr A. Varadharaj, Jt. Secretary, SAEST, proposed a vote of thanks.

Technical Sessions

The three technical sessions that followed the inaugural function focused mainly on the caustic alkali industries. In his invited lecture, William C. Meadowcroft of E.I. DuPont de Nemours, USA, gave a brief account of the development of ion exchange membrane to increase capacity in the chlor-alkali industry. The fluorine-based membrane belonging to his company's 'Nafion' series has been reported to work efficiently at currents varying over a given range. He also gave details on the characteristics of the nero-Nafion membrane which, he mentioned, would help industries boost and optimize the output of chlor-alkali manufacturing units. According to him, the new membrane functions at lower operating voltage between -60mV and -180mV. Operating the cells at lower voltages and higher currents would help reduce the cost of power consumed and the operating costs. He also mentioned that his group has tested the new membrane for its physical and chemical characteristics and found that there is no limit to the life time of these pre-fluorinated membranes in chlor-alkali service.

The first technical session on chlor-alkali electro-inorganic chemicals was chaired by Dr A.S. Lakshmanan, Dy. Director, CECRI. Seven technical papers were presented. The second technical session was on electro-organic chemicals. It was chaired by Dr S. Chidambaram, Scientist, CECRI. Eight papers were presented on various aspects pertaining to electro-or-



Dr T. Ramasami, Director, CLRI, inaugurating the Conference on Electrochemical Engineering and Technology ganic processes. The third technical session on electrodics, electrocatalysis, electro-chemical materials, etc. was chaired by Dr K.C. Narasimham, wherein two papers in electro-inorganic and four papers in other areas of work mentioned above were presented.

Dr Narasimham presented a paper on 'Role of electrochemistry in pollution abatement' in the third technical session. Shri Sahasranamam of UHDE India Ltd, and Dr M.S. Rajan of Birla Tech. Services, Delhi, presented a resume of their respective organizations. ❑

Road Traffic Safety and Human Rights

THE Central Road Research Institute (CRRI), New Delhi, jointly with University of Roorkee, organized a brain storming session on 'Road Traffic Safety and Human Rights' on 1 July 97 at Roorkee.

The session was chaired by Prof. S.K. Khanna, Chairman, Research Council, CRRI. Prof. Swamisaran of the Roorkee University welcomed the participants and deliberated briefly on population and vehicle growth, and increase in road traffic accidents.

Prof. Khanna stressed that the trip movements are becoming quite unsafe and cold feet is being shown towards the development of mass transportation system.

Prof. A.K. Gupta, Director, CRRI, in his opening remarks pointed out that every year, about 70,000 persons are killed in road accidents in India. Stressing that it is the right of everybody to reach home safely, Dr Gupta proposed that CRRI scientists can go to various states of India and conduct similar brain storming sessions to create greater awareness on the subject.

Dr S.M. Sarin, Deputy Director, CRRI, the key speaker, discussed the various provisions for human rights under Indian constitution and Directive Principles of State policies. He stressed upon the safe mobility of the pedestrians, cyclists and women travellers. Drivers of motor vehicles possess low opinion about pedestrians and there is an urgent need to create awareness regarding road safety. Dr Sarin also mentioned about the lack of knowledge regarding rules and regulations, and suggested to improve the motor vehicle driving licencing system, the improper functioning of which is well known. He also stressed upon better enforcement of traffic laws. Prof. Vasan of Roorkee University spoke about the safety audit of roads and need for more research on road traffic safety. Shri B.L. Suri, Scientist, CRRI, highlighted the deteriorating environmental conditions owing to traffic, and the consequent health effects due to polluted air, global warming and ozone depletion. Dr Kadiyali of Kadiyali Associates talked about enhancement of budget for road traffic safety and projected the future scenario of motor vehicles in India. Dr Nishi Mittal and Dr Anil Singh, Scientists, CRRI, respectively suggested for more facilities for women and elderly travellers and expressed concern about deteriorating air quality, especially in urban areas owing to road traffic. ❑

DEPUTATION BRIEFS

Dr P.R. Sheorey

DR P.R. Sheorey, Scientist F, Central Mining Research Institute, Dhanabad, visited the Democratic People's Republic of Korea as a United Nations Consultant for a month from 19 June 1997.

Dr Sheorey was assigned the task of expert appraisal of R&D status In the area of rock mechanics at the Anju Mining Engineering Institute which is under the State Academy of Sciences, DPR Korea.

During the visit, he taught the Korean researchers and coached them in various aspects of rock mechanics formulations in mining, suggested areas for future research after studying the Korean mining conditions and measures for improvement of their laboratory set up for strengthening the R&D effort.

Dr Sheorey is the first Scientist from CMRI to be appointed as a UN Consultant. He has a number of international publications including a book published from The Netherlands. ☐

HONOURS & AWARDS

Prof. A.K. Gupta

PROF. A.K. Gupta, Director, Central Road Research Institute (CRRI), New Delhi, has been appointed as a member of the Committee on 'Non-motorized Transport and Related Issues in Developing Countries', of Transportation Research Board (TRB), National Research Council, Washington, D.C., for the period 7 August 1997 - 31 January 2000.

The National Research Council (NRC) is the principal operating agency of National Academy of Sciences (NAS), USA, which is a private, non-profit corporation and non-government agency. NRC provide, many services on behalf of the federal government and the scientific and engineering communities. Members of the various scientific and technical committees of NRC serve not as representatives of the organizations but as individual scientists, technologists and research workers to make available their personal scientific knowledge to NRC activities.

Prof. Gupta participated in the activities of this Special Interest Group (SIG) at TRB, USA, during January 1997 and has contributed significantly to its attaining the status of a full committee of TRB, formed recently. Entire research programmes are routed through the committees of TRB. ☐

ANNOUNCEMENTS

Training-cum-Demonstration Programmes at CGCRI's Naroda Centre

THE Central Glass & Ceramic Research Institute's Naroda Centre proposes to conduct the following Training-cum-Demonstration programmes and capsule courses as part of its Human Resource Development activities:

Training-cum-demonstration Programmes

S. No.	Course		Time Schedule
1.	Physical Testing of Ceramic & Refractories Raw Materials	5,000.00	1 12 Sept.97
2.	Production of Acid Resistant Bricks and Tiles	3,000.00	15- 19 Sep. 97
3	Production of Wall Tiles	3,000.00	11-21 Nov.97
4.	Various Types of Ceramic Frits and their Compounding	5,000.00	1 12 Dec.97
5.	Making of Matt Glazes for Crockery & Table Wares	2,000.00	22-24 Dec.97
6.	Production of Glazed Roofing Tiles	5,000.00	5-9 Jan.98

Short-term/Capsule Courses

1.	Ceramic Raw Materials - Properties & Uses	500.00	22-23 Sep.97
2.	Processing and Grinding of Non-plastic Raw Materials	500.00	25 Sep.97
3.	Ceramic Fabrication Processes	500.00	29 Sep.97
4.	Different Types of Ceramic Bodies	500.00	1 Oct.97
5.	Medium Temperature (1200° - 1280°C) Ceramic Glazes	500.00	3 Oct. 97
6.	Ceramic Firing and Firing Schedules	500.00	24 Sept.97
7.	Defects & Remedies in Ceramic Bodies and Glazes	500.00	6 Oct. 97

Interested candidates are requested to register themselves for specified programmes in advance. For further information please contact: Dr K.N. Maiti, Scientist-in-Charge, Central Glass & Ceramic Research Institute's Naroda Centre, 168 & 169 Naroda Industrial Estate, Ahmedabad 382 330, Phone : (079)2823345 ; Fax: (079) 2822052. ☐

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit

Annual Subscription : Rs. 60
Editors : Dr B.C. Kashyap and Dr C.S. Gupta   Editorial Assistant : Neelima Handoo   Production : Kaushal Kishore   Single Copy : Rs. 3.00
Phone : 5786301   Gram : PUBLIFORM   Telex : 031-77271   E-mail: niscom@sirnetd.ernet.in.   Fax : 5787062
RN 4512/57

ISSN 0409-7467

CSIR NEWS

Foundation Day Celebrations

CSIR Young Scientist Awards and Technology Awards presented and Shanti Swarup Bhatnagar Prizes announced for 1997

ESTABLISHED in 1942, the Council of Scientific & Industrial Research (CSIR) celebrated its fifty-fifth Foundation Day on 26 September 1997. The day this year had a special significance — it fell at a time when the whole nation was celebrating its Golden Jubilee of Independence. All the CSIR laboratories/institutes celebrated the day with great enthusiasm by arranging lectures by eminent scholars, observing open days, and by holding exhibitions, cultural programmes, sports competitions and so on. More importantly, they took stock of what they had achieved and discussed plans for the future.

The main function was held in the NPL Auditorium in New Delhi. Prof. Yash Pal, National Research Professor, All India Council for Technical Education, New Delhi, presided over the function and gave away the 'CSIR Young Scientist Awards' and 'CSIR Technology Awards' for the year 1997.

The eminent cardiac surgeon Dr M.S. Valiathan who is presently Vice Chancellor of the Manipal Academy of Higher Education, delivered the eleventh CSIR Foundation Day Lecture on 'Saga of Indian Science & Technology'. Dr R.A. Mashelkar, Director General, CSIR, delivered the welcome address, and read out the citations of the award-winners. He also announced the names of the Shanti Swarup Bhatnagar Prize-winners for the year 1997.

Extending a warm and hearty welcome to the august gathering of eminent scientists and technologists, Dr Mashelkar said that it was a very special day for us, falling as it was at a time when the whole nation was celebrating Fiftieth Anniversary of its Independence and there was an atmosphere of nostalgia and jubilation all around. He thanked Prof. Yash Pal for accepting the invitation to preside over the function, and Dr Valiathan, to deliver the Foundation Day Lecture. These two personalities, Dr Mashelkar said, have made enormous contributions towards making social sense of science. Prof. Yash Pal has done pioneering work in the areas of elementary particle physics, cosmic radiation, space technology, science policy and so on. And whether he was in UGC, Planning Commission or Department of Science and Technology, he made a visible impact. The powerful and interesting TV serial on 'Planet' he made in partnership with USA and Australia has shown how science could be taken to the society in an innovative way— indeed he is a leader in the area. About Dr Valiathan, Dr Mashelkar said that he is the 'Father of Biomedical Technology in India'. A leading cardiac surgeon, who could have minted lot of money. But instead he chose the hard path to serve the society. Prof. Yash Pal and Dr Valiathan are pioneers — symbols of what is good and great in this country.

Speaking about the performance of CSIR, Dr Mashelkar referred to a comment made by Shri I.K. Gujaral, Prime Minister of India and President, CSIR, at the CSIR Society meeting held in the recent past: "CSIR is one of the finest things to have happened to the Indian science in the post-independence period". Indeed, it is a high praise and members of the CSIR family should be happy over this.

Taking stock of CSIR's performance in the past year, Dr Mashelkar said, "there are sufficient reasons for us to feel satisfied with our performance; we have made rapid strides towards reaching our potential. And this potential now seems to be even higher than what we had predicted in *CSIR Vision 2001*". In the direction of self-financing, CSIR generated over Rs 200 crore against the government contribution of around Rs 400 crore, i.e. 50% of what the government gave to CSIR. Expressing his happiness over this achievement he said, "It looked like we will not be able to cross this 'magic' barrier, but we have done it. And there are several other barriers that we will cross. I feel these are just the mental barriers. As far as our performance is concerned we can really jump many of these barriers — it is only a question of mind set." "And it is not only the money that we are talking about. After all what is Rs 200 crore? It is the quality that this money represents, the actual contribution that we have made to the industry and to the society — the new industrial production catalyzed, new products created, new value added to our indigenous resources, and so on", stressed Dr Mashelkar.

Dr Mashelkar further said that CSIR is becoming a global R&D platform. To make long strides it is necessary that one is able to decide where to compete and where to cooperate. And CSIR is cooperating with some of the best in the world. He cited the example of Indian Institute of Petroleum who had signed agreements with UNITEL, Stone & Webster and Universal Oil Products, etc. He made a special mention of Stone & Webster — one of the top engineering companies in the world, who has joined hands with IIP for licensing the IIP's technology on visbreaking in Latin America.

Dr R.A. Mashelkar delivering his welcome address at the CSIR Foundation Day function

From the old days, when the National Aerospace Laboratories (NAL) made the *Canard* research aircraft with everything taken from outside, Dr Mashelkar said, we have come a long way in the field of aerospace technology. We have made *Hansa* — the 2-seater all composite aircraft, and have successfully flown it. It is going to be commercially produced by the Taneja Aerospace. And now we are on the project on *Saras* — the 14-seater aircraft, and for this we are trying to get the support from Technology Development Board. This way we have opened up the Indian Civilian Aircraft Industry. Indead we are flying high!

"And on ground — look at what we have been able to do for the leather industry during the last year. In Tamil Nadu, of the 800 tanneries, 400 had been closed down by the High Court order, for want of green technologies. Some of the most underpriviledged people worked in these tanneries. CLRI-NEERI took up the task of developing green technologies. As a result, 100 tanneries have already been put back and more would be put back this year. You can yourself see what enormous impact it would make".

"An important change taking place in CSIR", Dr Mashelkar continued, "is that our people have really started moving out, to places we thought they would never go." He cited the example of CLRI scientists going to *Athani* — a small village in a remote corner in Karnataka, which makes all-leather *Kolhapuri chappels* and whose exports amount to around one crore rupees. The scientists stayed at the village for a month, interacted with the village artisans, called them to CLRI, and by a little scientific intervention they reduced the leather processing time from 35 days to just 15 days and produced the leather of a superior quality. And this intervention, though a small one, needed the expertise, the modern tools for proper understanding of the process and its standardization. This process has been found to be very much acceptable by the village artisans and would surly boost their output.

Dr Mashelkar expressed his happiness that CSIR is beginning to follow the link between not only science and economy, and self-financing, which forms a part of that link, but also science and social science and so on. "It is this connection that is going to take CSIR far ahead," he emphasized.

He also stressed the need to protect our traditional knowledgebase, and mentioned about CSIR challenging the US patent on turmeric powder and the US Patent and Trade Mark Office rejecting the patent*. "Last year, while giving a lecture on 'Intellectual Property Management in India — The New Challenge', which was presided over by Shri P.N. Haksar, I made the announcement that we are going to challenge the turmeric patent. There was a lot of apprehension as we had never done such things in the past. But at the end of the day we demonstrated that we understand the technical implications, by winning the case. The whole nation acknowledged this in a most extraordinary warm way. It is a small step but a significant one and the spin-offs are important". He stressed that we should chalk out strategies by which we would not only be able to protect our knowledge-base but also create value out of it, create wealth out of it. "This is where the CSIR is marching — a big battle lies ahead!".

Dr M.S. Valiathan delivering the CSIR Foundation Day Lecture

"This country had a freedom movement in the pre-independence period. Now as we enter the 21st century, we must have a knowledge movement — our intellectual property, tradional knowledgebase, biodivesity, etc. are just a part of it." "On this Foundation Day, we rededicate ourselves to the nation, and say, yes, we fully commit ourselves to being in this knowledge movement," said Dr Mashelkar.

Inviting Dr Valiathan to deliver the CSIR Foundation Day Lecture, Dr Mashelkar said that in the past we had lectures on Indian research, technology development and so on. Last year we heard Chief of the Hindustan Levers talking about global adventures. But it is important to have partnership not only with the future but also with the past — the traditional knowledge base not only of 50 years back but the whole past. And through Dr Valiathan's lecture, 'The Saga of Indian Science & Technology' we would take a peep in the past.

Dr Valiathan, with the help of a large number of beautiful colour slides, presented a glimpse of the status of S&T from the 'Pre-historic', 'Vedic', 'Later Vedic' periods to colonial period to the present.

He began with the Indus Valley Civilization (c 1750-1500 B.C), stressing that this civilization was not confined to *Mohanjodaro* and *Harrapa*, but all over Punjab, Haryana, Rajasthan and Gujarat. The reminiscents of this advanced civilization have been also found at Kalibangan in Rajasthan and Lothal in Gujarat, in addition to *Mohanjodaro* and *Harrapa*. These include bricks of uniform size (11" x 5.5" 2.5") and hundreds of kilns for making these bricks, and glazed pottery with inscriptions which we have not been able to read even today. The people then knew the copper-arsenic process for making alloys; obviously they had learnt it through experience. Copper-tin alloys were used for making sharp weapons and other articles, and for this reason the period is also known as the 'Bronze Age'. Tin was not available in India, it probably was brought from Iran. Minerals, such as jade, were used for making ornaments. All this shows that the people at that time had a significant amount of technology appropriate to the urban civilization.

---

*Detailed news will be covered in one of the forthcoming issues.

Coming to 'Vedic Period', Dr Valiathan said that people continued to use bricks, copper and bronze. They also used gold, silver and iron and it was the beginning of the 'Iron Age' in India. The people who worked with metals — iron, bronze or any other metal, were highly respected. A dominant thing of that time was the chariots. Constant reference of these, we have been able to read the scripts of that time, has been found not only in poetry and drama but even in philosophy and religion. Technologies for making leather articles, wines and use of medicinal plants began to appear. A very detailed description, classification and utilization of various plants for medical purposes has been found. The seeds for *Ayurveda* (the Indian System of Medicine) were sown.

In the 'Later Vedic Period' (800-600BC) people were highly intellectual in linguistics, science advanced and technologies flourished, particularly in the field of medicine and surgery. New disciplines were added to *Atharvaveda* (*Ayurveda* is a part of this) and it was completed during this period.

Texshila and Kashi became great centres of medical learning and students from neighbouring countries started coming here for study. An example of the clinical operations that used to be performed pertains to the reconstruction of the nose. Mention is found of one hundred blunt and 20 sharp instruments of that time.

The period till c AD 1000 is called the 'Golden Age of Indian Medicine'. Two great figures emerged: Charaka — who wrote *Charaka Samhita* covering Indian medicines, and Sushruta — who wrote *Sushruta Samhita* covering surgery as well as treatment of diseases.

People all over the world started knowing about the level of S&T in India with the coming of the East Indian Company, through which the information started flowing out. For example, an Englishman saw a person performing the operation for reconstructing the nose, under a tree in Maharashtra. He was amazed and made several illustrations of this extraordinary spectacle (one of which was shown by Dr Valiathan), and reported what he saw in the *Gentlmen's* magazine published from London.

But sadly, in the period following c AD 1000, creativity started drying up and the manual work was downgraded. The spirit of 'why' and 'how' was ruined and the experimentation died out. Sometimes in the name of religion, e.g. Sushruta had said that it was necessary to study the dead body to understand the anatomy, but the religion prohibited the people from cutting the dead body. Thus, we started losing what we had inherited. To show how difficult is it to come back to the same level once the creativity dies out, Dr Valiathan said, "Just imagine, if a vandal appears in India today, and destroys all R&D labs, IITs, IISc, BARC, etc. and all the libraries, it would take not less than 200 years to overcome this disaster".

By the 18th century, Dr Valiathan continued, the dark phase had started dawning on the country. The industrial revolution took place in the middle of the 18th century. India slept but Europe was wide awake. Under the colonial policy, technology finished and manufacturing declined in this country.

But if we see through the British eyes what was happening in this country even at that time — and there are many reports published in the *Proceedings of the Royal Society* — we find India was very advanced in terms of industrial development. We were producing high quality iron, artistic products of copper and brass and so on. Several Englishmen, including the chairman of the Industrial Commission, expressed at places such as Parliamentary Committee of England that 'India is not an agricultural country, she is a manufacturing country". "And here we are talking not only about the Dhaka muslin or a Kashmiri shawl", Dr Valiathan emphasized, "but a large variety of the articles which were manufactured here in a manner that made them superior than the ones manufactured elsewhere in the world."

Elaborating on the industrial production during the 18th Century, Dr Valiathan cited several examples. About iron production, he said there were iron mines in many parts of country and from 170- 180 *sears* of ore and around 140 *seers* of charcoal (softcoke), 70 *seers* of high quality iron was produced. (Dr Valiathan showed slides of furnaces and bellows used for extracting iron.) "We would have never known this, had Dharmpal not made an exhaustive effort and published his discoveries. His publication is a valuable source of information about the Indian S&T during the 18th century". Towards the healthcare, the practise of innoculation (called *tikka*) was prevalent, and it was believed that when the vaccine enters into the body, a fermentation takes place, which does not allow the occurence of a second fermentation (immunization).

Concluding his lecture Dr Valiathan said that lessons to be learnt from the past are that deliberation of the technology whether pertaining to social, intellectual or economic aspect is very important; a country which downgrades its technology is destined to be ruined, and the technology that does not have intellectual creativity is vulnerable. Also, S&T institutions should not only produce scientists but also provide useful members to the society who will take this country forward.

The Foundation Day Lecture was followed by presentation of the awards by Prof. Yash Pal, and his presidential address.

In his address, Prof. Yash Pal deliberated upon the gap between the Science and Society in this country. He said that the reason why people keep on asking "what scientists have given to this country except a few missiles, satellites, etc.", is not very difficult to understand. Mainly, it is the poor visibility of our S&T accomplishments and their closeness to the needs of common people that make them think that our scientists have not done much for the society. When the people sit before a TV and watch the advertisements of the various products that they need, whether these are toiletries, electronic goods, motorcycles or any other thing, they find that most of these bear foreign or Indo-foreign brands. So they presume when the brand name is foreign, the technology would have also come from outside. And this has become more so after the liberalization. Thus the vast amount of our S&T accomplishments in the field of agriculture, industrial research, medical research and so on go unnoticed. This aspect will have to be handled collectively by the S&T institutions, universities, social scientists, politicians and all others involved in taking science to the people, stressed Prof. Yash Pal.

Prof. Yash Pal delivering his presidential address

Prof. Yash Pal pointed out that India has a vast network of S&T institutions and university system with amazing amount of capabilities. But people think nothing of the whole lot of innovative things that we do, because they feel these are not central to their needs. To cite an example, he took the case of space technologies. India has developed tremendous amount of expertise in this area — missiles, PSLV, satellites and so on. A whole lot of communication, computer, materials, electronics and chemical S&T has gone into these. But a common man does not know about these. Because the spin-offs from all these marvellous innovations have not been properly exploited. They remain like hard balls. Not addressed to the problems of the common man. So the need is to exploit the spin-offs, produce things that would help the common man, emphasized Prof. Yash Pal.

Another important aspect Prof. Yash Pal touched upon is the need to have connectivity, proper coordination, between the various disciplines of science & technology. We have specialities. But for want of interaction, we are not able to produce the things that we could. We have to break the barriers, the compartmentalization and couple all kind of things.

Lastly, Prof. Yash Pal spoke about the enormous subterranian, non-formal education system that exists in the country. He said a lot of innovations keep on happening in this non-formal system, which are directly related to the needs — by the farmers working in the fields, mechanics working in the car garages, electronic shops, and practically everywhere. These are people who never had formal education, but they have learnt through their experience and inbuilt talent and zeal for creativity. He cited the example of a farmer in Punjab who made the use of motor meant for pumping water, to drive a vehicle. He asked himself, "the motor is used only for a few hours to pump the water, so why cannot I use it for driving the vehicle when it is not needed for pumping the water." He made some innovations, procured clutch plates, steering wheel, etc. from a junk shop and fitted the motor on a vehicle. This way, he started using the same motor for pumping the water and, on mounting it on the vehicle, for driving the vehicle. The cost of the vehicle came to just Rs 30,000 and its speed 40-50 km/h, sufficient to serve his purpose. He called it *Maruta*, saying that "people travel in their *Marutis*, I travel in my *Maruta*". And now this innovation has spread all over and one finds a large number of people in the countryside driving *Marutas*. Another vehicle developed by shear innovative skills is *Jugad*. Another interesting example Prof. Yash Pal narrated was that of a farmer who started growing sunflower along with grain crops. When told by our agricultural scientists that growing of sunflower with grain crop was going to be harmful because birds would be attracted by the sunflower and eat away all the grains, the farmer answered, "Do you think I am a fool. I am also doing bee-keeping. I have found that with bees in the field, birds do not come, and then I am also getting honey." Now, in Punjab, one usually grows three crops and this man was growing four crops and was also getting honey. A real innovation indeed! Something which our agricultural scientists also do not know. Similarly we have mechanics who are able to repair all types of motor vehicles. The mechanics who are able to repair all types of gadgets — Indian and even imported. Not only these, the whole lot of people in different professions — the goldsmiths, carpenters and so on. Most of these never went through the formal education. They learnt from their *ustads*, and are able to carry out the jobs. There is a need, Prof. Yash Pal stressed, to have a seamless connection between this non-formal and the formal systems of knowledge. Very difficult indeed! Mainly because of our education system — the entrance exams, the degrees and so on. But if we are able to establish this seamless connection, give the people with talent in the non-formal system, the power and respect which they deserve, we can really do wonders. In fact, the students in the engineering colleges, he suggested, should be made to make a *Maruta* or *Jugad* to make them understand the way the innovation takes place. And this connection between the formal and non- formal systems of knowledge would lead to the innovations that are centre to the real needs, concluded Prof. Yash Pal.

Dr Krishan Lal, who was officiating as the Director of NPL at that time, proposed a vote of thanks.

Shanti Swarup Bhatnagar Prizes-winners for 1997

Biological Sciences

Dr J. Gowrishankar, Centre for Cellular and Molecular Biology, Hyderabad

and

Dr Kanury Venkata Subba Rao, International Centre for Genetic Engineering and Biotechnology, New Delhi

Chemical Sciences

Dr Kankan Bhattacharyya, Indian Association for the Cultivation of Science, Calcutta

and

Dr A. Srikrishna, Indian Institute of Science, Bangalore

Engineering Sciences

Dr Devang V. Khakhar, Indian Institute of Technology, Mumbai

Medical Sciences

Dr Satish Kumar Gupta, National Institute of Immunology, New Delhi

and

Dr Vijay Kumar, International Centre for Genetic Engineering and Biotechnology, New Delhi

Physical Sciences

Dr Bikas Kanta Chakrabarti, Saha Institute of Nuclear Physics, Calcutta

and

Dr Amitava Raychaudhuri, University of Calcutta, Calcutta.

No awards in the Earth, Atmosphere, Ocean and Planetary Sciences and Mathematical Sciences have been recommended this year.

ABOUT THE AWARDS

Shanti Swarup Bhatnagar Prizes

Instituted in 1957, the Shanti Swarup Bhatnagar Prizes are the most coveted S&T prizes in India. These prizes, each carrying a cash award of Rs 1,00,000, a citation and a plaque, are awarded annually for notable and outstanding research, applied or fundamental, in: (1) Mathematical, (2) Physical, (3) Chemical, (4) Biological, (5) Earth, Atmosphere, Ocean and Planetary, (6) Engineering, and (7) Medical Sciences.

Any citizen of India engaged in research in any field of Science and Technology, who is not more than 45 years old on 31 December of the year preceding the year of the Prize, is eligible. He/she should have made, in the opinion of CSIR, con-

CSIR Young Scientist Awards 1997

CITATIONS

Biological Sciences—Awarded to Dr Neena Goyal of the Central Drug Research Institute, Lucknow. She has developed an axenic culture of amastigotes of the Indian strain of *Leishmania donovani* Dd-8 and characterized the same using biochemical and ultrastructural parameters. The axenic cultures have important applications in terms of drug screening and antigens for vaccine production.

Chemical Sciences—Awarded to Dr Srivari Chandrasekhar of the Indian Institute of Chemical Technology, Hyderabad, for his significant contributions in the area of synthesis methodologies for the Carbon-Carbon bond formation, oxidations and reductions and designing of protective groups. He has tried to apply some of these for the synthesis of designed molecules.

Engineering Sciences—Awarded to Dr Indranil Chattoraj of the National Metallurgical Laboratory, Jamshedpur, for his significant contributions towards the understanding of switching process in amorphous Fe-Si-B fibres by controlled hydrogen impregnation and in the area of hydrogen degradation of steel.

Physical Sciences—Awarded to Dr Snehashish Chakraverty of the Central Building Research Institute, Roorkee, for carrying out sustained work on the vibration characteristics of plates of different shapes using orthogonal polynomials.

and

To Dr Ranjan Kothari of the National Physical Laboratory, New Delhi, for developing the technology of making activated carbon cloth and assisting in the upscaling of the process for its industrial exploitation. ☐

CSIR Young Scientist Award-winners with Prof. Yash Pal, Dr M.S. Valiathan, Dr R.A. Mashelkar and Dr Krishnan Lal

spicuously important and outstanding contributions to human knowledge and progress —fundamental or applied — in the particular field of endeavour, which is his/her specialization. The prize is awarded on the basis of contributions made through work done primarily in India during the five years preceding the year of the prize.

CSIR Young Scientist Awards

Introduced in 1987, these awards are open to regularly employed scientists working in CSIR system who have not attained the age of 35 years by 26 September of the preceding year. The awards are given for outstanding contributions made by the young CSIR Scientists, based on work done primarily in India. The awards are given annually, in the following fields: Physical Sciences (including instrumentation); Chemical Sciences; Biological Sciences; Engineering Sciences; and Earth, Atmosphere, Ocean and Planetary Sciences. Each award consists of a cash prize of Rs 25,000, a citation and a plaque.

CSIR Technology Awards

With a view to fostering and encouraging inhouse multidisciplinary team efforts and external interaction for technology development, transfer, marketing and commercialization, CSIR, in 1990, instituted two sets of Technology Awards, viz. *A*. Technology Shields and *B*. Technology Prizes.

A. Technology Shields

One shield each for Process and Engineering Technology, awarded to a laboratory/group for its outstanding technological contributions/achievements in an area/field. The award comprises a rolling shield, a citation, a plaque and a one time grant of up to Rs 30 lakh for the project.

B. Technology Prizes

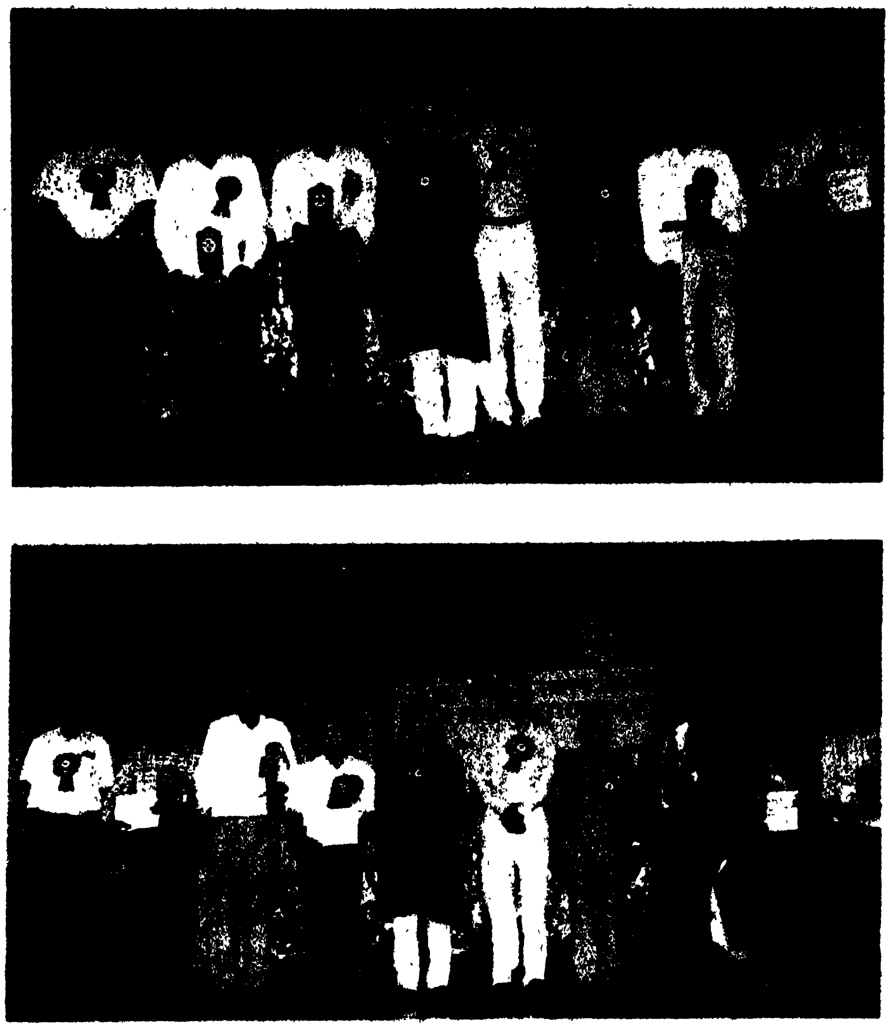
One prize each in the areas of Biological, Chemical, Engineering and Materials Technology, and for

CSIR Technology Awards:1997

CITATIONS

***Prize for Chemical Technology*—** **Awarded to the team at Indian Institute of Petroleum (IIP), Dehra Dun, comprising: Dr(s) A.K. Gupta, H.B. Goyal, K.S. Jauhri and Shri K. G. Sharma, for development of a comprehensive technology package comprising process knowhow and basic engineering for an improved process for preparation of Tetramethylene Sulfone (Sulpholane), incorporating a proprietary inhibitor & innovative chemical engineering techniques, thereby enabling the Indian industry to become one amongst the three producers of sulpholane in the world.**

***Prize for Business Development & Technology Marketing*—** **Awarded to the group at National Geophysical Research Institute (NGRI), Hyderabad, comprising: Dr(s) H.K. Gupta, C.P. Gupta, D.C. Mishra, P.R. Reddy, S.V.S. Sarma, S.B. Singh and S.I. Reddy, for its achievement in significantly enhancing the business for NGRI's knowledgebase through new initiatives, innovative methodologies in hydrocarbon exploration and creative business strategies, resulting in a remarkable growth in the externally contracted work. As a result of their meticulous and painstaking efforts, NGRI is now recognized as a pioneering geophysical research organization not only in India but also internationally.** ❑



CSIR Technology Award-winners — IIP team (*top*) and NGRI team (*above*) — with Prof. Yash Pal, Dr M.S. Valiathan, Dr R.A. Mashelkar and Dr Krishan Lal

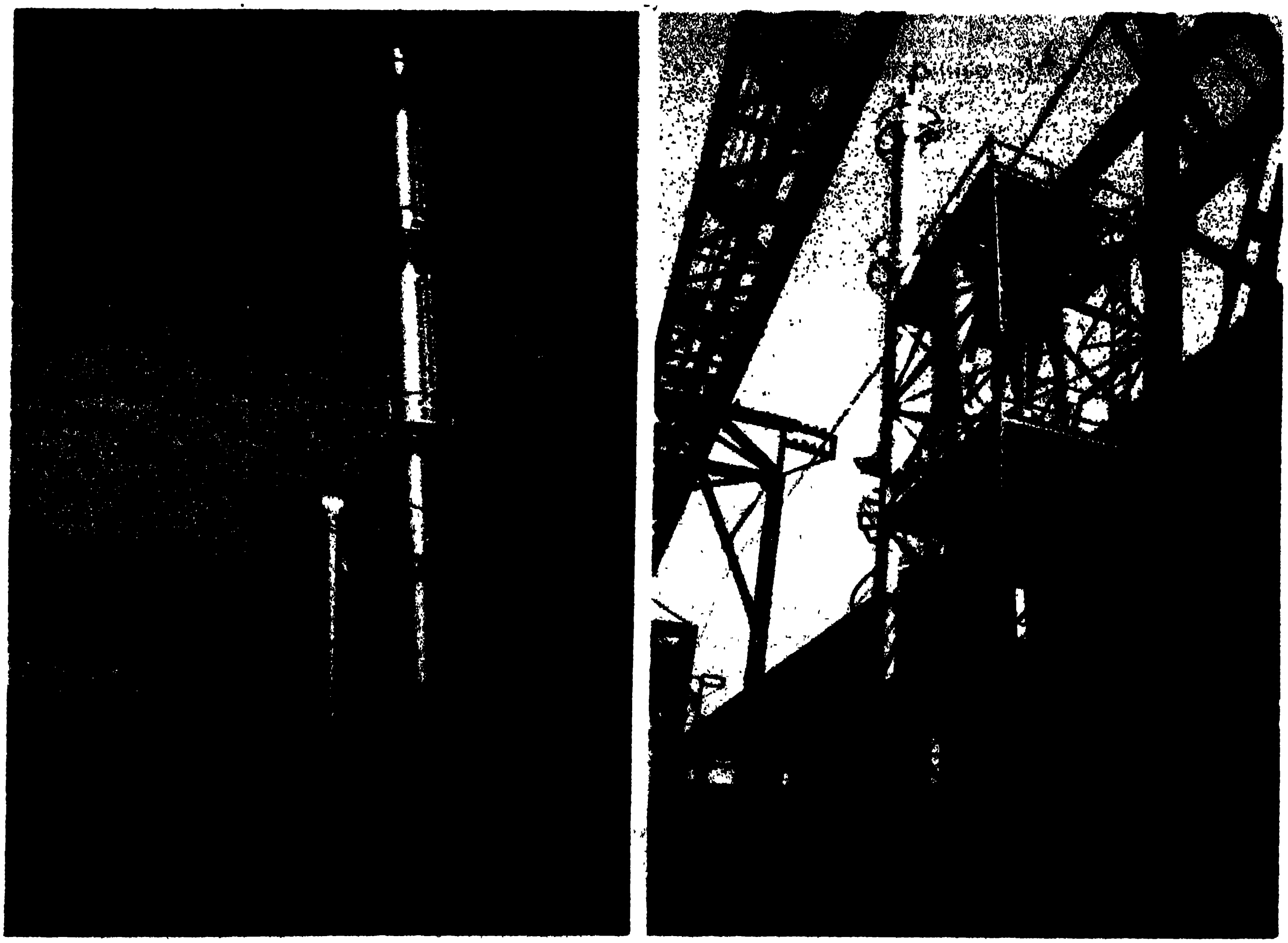
Business Development and Technology Marketing. The Prize is awarded to group(s) of CSIR personnel and contributors external to CSIR for an outstanding and specific technological achievement. The Prize comprises a cash award of Rs 1 lakh shared among the awardees, a plaque and a citation to each member of the award winning group.

As CSIR marches ahead to meet the targets set in the *Vision 2001*, the selection criteria for these awards are being made more and more stringent — the research findings should now have novelty and competitiveness not only at national level but at the global level. This is the reason that no Technology Shields have been awarded, and only two of the five Prizes have been given this year. ❑

Gas Cleaning Systems for Coke-based Foundries

INDIA is fast emerging as an important global player in the foundry sector of metallurgical industry. Owing to service constraints on pollution, production of castings is on decline in the developed countries. As a result, orders are being placed on the Indian industry. Additionally, growth in automobile and machine tool sectors is also contributing to increase in demand. Simultaneously, there has been a growing awareness of environmental pollution in our country. The situation has been brought to a boil with the case of Taj at Agra. There are about 6000 foundries currently operating, mostly as clusters, in Ahmedabad, Agra, Batala, Coimbatore and Howrah and most of these are coke based. Coke-based foundries are plagued with pollution control problems. Normal stack emission from foundries ranges from 400 to 3000 mg/m^3 of suspended particulate material (SPM). As per the directive of the Supreme Court of India, the pollution has to be within the acceptable limit fixed by the Central Pollution Control Board (CPCB), which specifies that the SPM level in the cupola emissions must not be more than 150 mg/m^3. As a result of this stringent specification, most of the foundries are facing uncertainties for their existence. Many have already been shut down. More are facing closure.

Considering the enormity of the problem from technical, economical and social angles, the National Metallurgical Laboratory (NML), Jamshedpur, has carried out considerable R&D work and developed a low capital intensive and dry gas cleaning system of various modules/sizes in order to meet the re-



A general view of Gas Cleaning Plant (*left*), and the Ducting, cyclone and chimney of the gas cleaning system, installed at IISCO (Kulti), by NML quirement of cupolas ranging from 2 to 25 tonnes/h capacities. This technology has been successfully transferred on a turnkey basis and saved the closure of some of the units.

Based on the design developed at NML, some foundries at Howrah, West Bengal have constructed gas cleaning facilities in their cupolas and obtained results within the specifications of CPCB.

The first NML-CPCB demonstration pollution control unit was set up in M/s Crawley & Ray, Howrah, in November 1995. The second demonstration unit with NML technology was set up in M/s Shree Uma Foundry Pvt. Ltd, Liluah (Howrah) in April 1996. The work was funded by the Indian Foundry Association, Calcutta. And then in July 1996. NML's technology was commercialized by the Indian Iron & Steel Co. (IISCO), Kulti—a subsidiary of SAIL. The Central Growth Works (CGW) at Kulti has the distinction of having 12 cupolas which are oldest and the biggest in India. The foundries at CGW were facing closure notice from the Supreme Court, in case the suspended particulate matter was not brought down below 150 mg/m^3 from the then existing level of ~ 2000 mg/m^3 before January 1997. They requested NML to design and install gas cleaning system (GCP) in their three sets of cupolas on a turnkey basis. This is for the first time that NML took up a turnkey job worth Rs 14.4 million and completed the same within six months from 'concept to commissioning', enabling the CGW-Kulti Works (SAIL) to meet the deadline set up by the Supreme Court. The systems erected by NML are functioning efficiently and have met the CPCB's norms effectively. All modules of

CSMCRI Scientists win NRDC Technology Award

DR R.S. Somani, Dr P.M. Oza, Shri V.M. Sheth* and Shri M.R. Gandhi have been awarded the prestigious Technology Award by National Research Development Corporation, New Delhi, on the eve of Independence Day, the 15 August 1997, for developing technology for detergent grade Zeolite-A, a recommended substitute for sodium tripolyphosphate, presently used in the manufacture of detergent as building material. The award carries Rs 100,000 in cash.

The award-winning process technology consists of reacting sodium aluminate liquor and sodium silicate solution under optimized conditions to form gel which is further subjected to crystallization, resulting in formation of Zeolite-A. The process has since been released to National Aluminium Company Limited (NALCO) at a premium of Rs 13.5 million. The firm is installing a plant of capacity 10,000 tonnes/day at Damanjodi in Orissa.

Dr R.S. Somani (born, 13 August 1957) joined CSMCRI in 1978 as Junior Laboratory Assistant. The Bhavnagar University awarded him Ph.D. for his work on 'Studies on synthetic silicates' in 1987. Presently a Scientist B, Dr Somani has to his credit 22 research papers and two patents besides seven technical reports. He has visited Germany under DAAD fellowship, and Japan to attend an International Symposium on Zeolites and Microporous Crystals.

Dr P.M. Oza (born, 24 October 1943), presently Scientist E II, joined CSMCRI in 1965 as Graduate Apprentice (Graduate Trainee). He obtained his Ph.D. from Saurashtra University in 1972 for his work on 'Radiation chemistry of aqueous organic systems and low- level gamma ray dosimeter'. Dr Oza has published 27 research papers. He has one patent and seven process know-how to his credit. He visited Germany to participate in 19th Course of International Seminar.

Shri M.R. Gandhi (born, May 1954), a B.E.(Chemical), joined CSMCRI in 1976 as Junior Research Fellow. He has developed six processes and published 17 research papers besides 12 technical/project reports. He has two patents to his credit. Shri Gandhi visited Switzerland for Solar Energy Project and China (Qinghai Institute of Salt Lake) under TWAS fellowship. He is a member of IIChE. □

*** Has taken voluntary retirement.**

the systems are light weight, and have fewer capital equipment. These consist of ductings to carry all the SPM in flue gas discharged from cupola, high pressure cyclones, ID fans, chimney, dust disposal unit and rotary air lock discharger. In most places where the foundries are located, there is scarcity of water. Further, use of water has to be restricted since there are also limits on soil pollution from discharged effluents. Each of the system has been tailor made for the specific foundry, after analyzing the SPM level and the particle size distribution. The developed gas cleaning system is dry-type and therefore cheaper and cost effective. Maintenance cost is also very low. The entire plant can be operated through remote controls by few individuals.

In India, only a few foundries have gas cleaning system. NML design can benefit all the foundries having cupolas using coke as fuel. Details regarding foundries who have adopted the gas cleaning system based on NML's know-how are as follows:

1. Shree Uma Foundries, Howrah

(i) No. of Cupolas : 1, (ii) Capacity: 6 tonnes/h, (iii) Dia : 1100 mm, (iv) Height : 12 m, (v) Flue : 2500 m^3/h, (vi) Dust load: 1700 mg/m^3. NML-designed gas cleaning plant (GCP) consists of : Steel pipe ducting 500ϕ ID-40m; Cyclone 1000ϕ - 3 Nos.; ID Fan - 40000 m^3/h with 50hp motor; Rotary lock feeder; Structures 10 tonnes; Chimney 850ϕ ID, 25m in height, fixed on suitable civil foundation.

2. CGW, IISCO (SAIL), Kulti

(a) Heavy mechanized foundry (HMF): (i) No. of cupolas : 2, (ii) Capacity : 5 tonnes/h, (iii) Dia ID : 1.02 m, (iv) Height: 12 m (v) Flue : 25000 m^3/h Rate Temp.: 250°C (vi) Dust level: 1500 mg/m^3, (vii) Coke consumption : 1.5 tonnes/h. NML-designed Gas Cleaning Plant (GCP) consists of : Ducting 600ϕ ID - 40 m; Cyclones 1000ϕ - 4 Nos.; ID fan 25000 m^3/h. at 300 mm WG coupled with VIV and motor of 50 hp; Diverting valves, Dust collecting chute, Rotary lock feeders; Structure 10 tonnes; Chimney- 850ϕ ID, 30 m height, fixed on suitable civil foundation. Instrumentation for temperature, pressure and dust load measuring device. Motor control centres based on remote control operation. Final dust load through chimney below 90 mg/m^3.

(b) General casting shop (GCS): (i) No. of cupolas : 2, (ii) Capacity : 14 tonnes/h, (iii) Dia,ID: 1.82 m, (iv) Height: 1.52 m. (v) Flue : 38000 m^3/h Rate, Temp.: 350°C, (vi) Dust level: 1800 mg/m^3, (vii) Coke consumption: 2.5 tonnes/h. NML- designed Gas Cleaning Plant (GCP) consists of : Ducting 800ϕ ID - 40m; Cyclones 1000ϕ - 6 Nos.; ID fan 40000 m^3/h at 300 mm WG coupled with VIV and motor of 75 hp; Diverting valves. Dust collecting chute, Rotary lock feeders; Structure 20 tonnes; Chimney - 1000ϕ ID, 30 m height fixed on suitable civil foundation for temperature, pressure and dust load measuring device. Motor control centres based on remote control operation. Dust load through chimney was found to be below 90 mg/m^3.

(c) Spun pipe plant - 2 (SPP-2) : (i) No. of cupolas : 2, (ii) Capacity : 20 tonnes/h, (iii) Dia ID : 1.83 m, (iv) Height : 18.29 m, (v) Flue: 50000 m^3/h, (vi) Dust level: 1800-2000 mg/m^3, (vii) Coke consumption: 2.5 tonnes/h. NML-designed Gas Cleaning Plant (GCP) consists of : Ducting 900ϕ ID - 120m; Cyclones 1000ϕ - 8 Nos.: ID fan 50000 m^3/h. at 300 mm WG coupled with VIV and motor of 100 hp; Diverting valves. Dust collecting chute, Rotary lock feeders; Structure 20 tonnes; Chimney-1000ϕ ID, 30m height, fixed on suitable civil foundation. Instrumentation for temperature, pressure and dust load measuring device. Motor control centres based on remote control operation. Dust load through chimney is now below 60 mg/m^3.

NML's technology has brought in benefits not only from economic point of view but also from social point of view. The foundries were facing the problem of closure owing to pollution but now these are in a position to even export the product to other developing countries and compete in the global market. Further, it has also saved retrenchment of about 10,000 employees, apart from improving the quality of life in the surroundings. ❑

Workshops

Pulse Milling & Distribution of Mini Dall Mills

THE Central Food Technological Research Institute (CFTRI), Mysore, and CSIR Polytechnology Transfer Centre (PTC), Bhopal, jointly organized a Workshop on Pulse Milling during 7-10 August 1997. The programme was sponsored by United Nations Development Programme (UNDP) and Technology Mission for Oilseeds & Pulses (TMOP).

Attended by 30 entrepreneurs, representatives of NGOs, self-help groups including women entrepreneurs, the programme was conducted by scientists of Grain Science Division of CFTRI. It comprised intensive practical training and lectures on grain science.

Shri Sundeep Khanna, Principal Secretary, Commerce & Industry, Government of Madhya Pradesh, was Chief Guest at the valedictory function. In his address, he appreciated the mini dall mill developed by CFTRI, for small entrepreneurs and hoped that a large number of unemployed youths in villages and semi-urban areas would benefit from this machine. He also handed over the certificates and documents for free distribution of 20 machines to entrepreneurs.

Earlier, Shri M.S. Virdi, Project Officer, PTC, Bhopal, welcomed more than 150 dignitaries and delegates attending the session and spoke about the various technologies of CFTRI, which had been introduced in Madhya Pradesh through the efforts of PTC, Bhopal.

Dr V. Prakash, Director, CFTRI, presided over the programme. He informed that CFTRI had transferred technologies to 1500 entrepreneurs in the country, and assured all help to the industrialists and entrepreneurs of M.P. on priority as there is vast scope for setting up agro-based industries here.

Dr T.C. Rao, Director, Regional Research Laboratory (RRL), Bhopal, also addressed the delegates and appreciated the efforts of PTC, Bhopal, in rural industrialization and assured all help from RRL, Bhopal, in such programmes.

Smt. Shobha Marwah, IAS, representing TMOP, gave details of the National Programme. Some of the beneficiaries representing NGOs also expressed their views.

Dr H.V. Narasimhan, Scientist, CFTRI, proposed a vote of thanks. ❑

Mining of Thick Coal Seams developed on Pillars with Cable Bolt Support

THE Central Mining Research Institute (CMRI), Dhanbad, organized a one-day workshop on 7 September 1997, on 'Mining of Thick Coal Seams developed on Pillars with Cable Bolt Support' which is a newly developed technology of the institute.

The purpose of organizing this workshop was to explain the technology in details to the representatives of different coal companies, DGMS and educational institutes on mining science so that the knowledge developed by CMRI is properly disseminated and the technology gets its way from laboratory to the field.

The inventor of the technology, who is also the Acting Director of the institute, Dr T.N. Singh in his address said, "The depillaring of thick coal seams standing on pillars has been a great challenge to the Indian coal industry. In spite of the best efforts and even at exorbitant operational costs, the solution has been far from satisfactory. The level of recovery has been within 30 to 40% sterilizing a large portion of valuable coal and inviting danger of heating and fire".

"As a solution to this long standing problem, CMRI has developed the technology of mining thick coal seams developed on pillars with cable bolt support, which has been successfully experimented at NCPH coal mine of Chirimiri area under SECL".

According to Dr Singh, this technology would enable depillaring of 5 to 10m thick coal in single pass and thereby increase the level of recovery to about 75%. It would also provide better roof control even after blasting and heightening of the roof, ensure free movement of man and machine, and minimize danger of spontaneous heating of coal.

He claimed, "No comparable technology for depillaring thick

Dr T.N.Singh interacting with the participants of the workshop on 'Mining of Thick Coal Seams developed on Pillars with Cable Bolt Support' seam (more than 5 m) is available anywhere in the world. In fact the seams in other countries are of lesser thickness. It is the problem of India where over 58% of the total coal seams are of over 5 m thickness under shallow depth cover. Caving of seams over 4.8 m has not been possible so far because of the limitations of conventional supports".

At the end of his deliberations, Dr Singh expressed his deep gratitude for the Ministry of Coal, Government of India, for financing the experiment and conveyed hearty thanks to DGMS and SECL for their unstinted cooperation during the experiment.

It may be added here that this invention has already earned him NRDC Award for the year 1995 along with another CMRI scientist, Shri B.K. Dubey. ❑

Resin Transfer Moulding

A workshop on 'Resin Transfer Moulding' (RTM) was organized by the National Aerospace Laboratories (NAL), Bangalore's Structures Division, during 18-20 August 1997.

The workshop evoked an excellent response with 40 registrations, including a large contingent from industry.

Welcoming the participants, Dr B.R. Somashekar observed, "The presence of so many participants is an ample proof of the growing importance of composites. It also confirms that the Indian industry now recognizes that it cannot compete internationally without proper training".

The workshop, conducted by Mr Tonu Malm and his colleague from Aplicator Systems, Sweden, was inaugurated by Dr K.G. Narayanan, Director, ADE. Describing the workshop as "extremely timely", he said that the Indian aerospace community is currently buzzing with action and RTM technology should be of great importance in volume production of composite technologies. Complimenting Dr T.S. Prahlad, Director, NAL, and his colleagues from Structures Division, he said, "By organizing this workshop NAL has again chosen to play the role of a national catalyst to the composites industry".

Dr Prahlad in his address said that NAL recognizes RTM as "one of the technologies of the future", and added that it was time to move on from simple hand lay up techniques.

Dr Kota Harinarayana, Programme Director, LCA, released the workshop material and expressed his happiness that the "RTM workshop is finally a reality" (ADA and Dr Kota himself had supported the workshop in a very big way). Discussing composite technologies, Dr Kota said, "when strength is a major factor, RTM technology will prove to be very useful".

In his brief remarks, Mr Malm explained how the eco-friendly RTM technology is rapidly gaining ground in the European composite industry with applications not only in aerospace "but also in automobiles, sanitary ware, furniture and buildings.

The workshop was the outcome of an assiduous effort by Dr Ramesh Sundaram (who was warmly applauded) and Mr M. Subba Rao (who was described as the "resin which binds the different fibres of NAL's Advanced Composites Unit") over the past 15 months. ❑

TRAINING PROGRAMMES

IIP conducts Training Programme for Marketing Personnel of MICO Ltd

THE Indian Institute of Petroleum (IIP), Dehra Dun, conducted a ten-day training programme for the marketing personnel of MICO Ltd, Bangalore, during 26 August - 5 September 1997. The course content, which dealt with Application of Fuels and Lubricants in Automotive and Industrial Machines, was prepared by IIP in consultation with the management of MICO Ltd, in order to meet the specific requirements of the participants. The programme was inaugurated by Shri Sudhir Singhal, Area Co-ordinator, Petroleum Products Application Division of IIP, who advised the participants to learn the subject well in order to satisfy the customer in the highly competitive lube market.

Dr Himmat Singh, Deputy Director and Area Leader of IIP's Training Division, welcomed the trainees and told that this was the fourth training programme organized by IIP during this financial year and the first one for the MICO Industries. Classroom lectures, laboratory visits and practicals were held during the programme. The lectures delivered were mainly devoted to fundamentals of crude oils, testing of lube oils, characterization of lube base stocks, basics of IC engines, performance tests and evaluation of deposit rating.

The twelve participants who attended the programme were also given demonstrations of diesel and gasoline test benches, octane, cetane rating, standard test benches and engine deposit rating.

The faculty was drawn from within IIP. A lecture on 'Physics, chemical testing of lube oils and greases' was delivered by Shri S. K. Chibber. Dr Himmat Singh talked about the characterization of lube base stocks, Dr S. K. Singhal gave a lecture on diesel fuels and Shri K.K. Gandhi on 'Vehical emission legislation and control'.

Shri V. P. Sharma, Course Coordinator, proposed a vote of thanks.

A sea change is underway in the Indian petroleum refining/petrochemical sector due to globalization and concerted efforts are being made through several private sector joint ventures to boost refining capacity.

The Training Division of IIP has been conducting several programmes and courses for petroleum industry personnel from the engineering as well as marketing and management spheres. A well-equipped library and highly qualified faculty makes IIP an ideal body to carry out these training programmes throughout the year. ❑

Training Programme for Reliance Industries' Engineers at IIP

A ten-day training programme on 'Petroleum Refining and Petrochemicals Technology' for 31 chemical engineers from Reliance Industries Limited (RIL), Patalganga, was inaugurated on 15 September 1997 at the Indian Institute of Petroleum (IIP), Dehra Dun, by Shri Sudhir Singhal, Seniormost Scientist and Area Co-ordinator of PPAD and AASD.

Shri Singhal in his address welcomed the trainees and advised them to work hard in today's highly competitive market to increase their company's profitability.

Shri S. M. Gupta, Senior Manager from RIL, in his remarks said that IIP is the leading institution in the country in the area of petroleum research, and RIL is extremely happy to join hands with IIP for some collaborative work, and for training of its engineers. He said that this was the first batch from RIL in this financial year and RIL is planning to send two more batches in the coming months.

Earlier, Shri V.P. Sharma, Assistant Director and Course Co-ordinator, while welcoming the participants, informed that this is the first programme for RIL and fifth training programme in this financial year.

The contents included lectures on crude oil and petroleum products, refining process technology, conversion and treating processes and general lectures on production planning, environmental control and fire and safety in refineries. The course started with an 'Introduction to IIP' by Dr K.S. Jauhry, Deputy Director and Head, Industrial Liaison Services.

The faculty for the programme has been mainly drawn from amongst the working scientists of IIP and from Engineers India Ltd (EIL), OCC and OISD, New Delhi. ❑

Training & Demonstration Programme for Chemical Testing of Ceramic and Allied Raw Materials

THE Central Glass & Ceramic Research Institute's Naroda Centre organized a Training and Demonstration Programme on 'Chemical Testing of Ceramic and Allied Raw Materials', during 21 - 31 July 1997.

The nine-day programme comprised theoretical lectures with practical demonstration on testing of different types of ceramic raw materials like quartz, potash feldspar, china & ball clays, fire clays, other alumino-silicates and aluminous materials, zirconium silicates, frits &

Participants of the training & demonstration programme of 'Chemical Analysis of Ceramic Raw Materials'.

glasses, etc. The course also discussed the various requirements for setting up a chemical laboratory for analysis of the above mentioned raw materials. Five participants, including three from Gujarat State, attended the programme. ❑

OBITUARY

Shri P.S. Shankar

CSIR *News* records with deep regret the sad demise of its ex-Editor Shri Podali Sampangiramiya Shankar. He expired on 23 August 1997 in New Delhi, after a brief illness.

Shri Shankar (born, 23 August 1929) had joined the National Institute of Science Communication (then Publications & Information Directorate), New Delhi, on 1 October 1959, and served as Editor of the semi-monthly CSIR newsletter for around 17 years (1968 - 84). In addition, he brought out, for years together, publications such as CSIR Handbooks, Annual Reports and brochures; status reports on S&T in India; and edited several advanced-level monographs. He also served as Editor of *Journal of Scientific & Industrial Research* and *Indian Journal of Fibre & Textile Research* for a brief period.

Shri Shankar also played a significant role towards human resource development as a faculty member of the various courses in the field of S&T communication at INSDOC, NISCOM, etc.

A sincere and upright human being, Shri Shankar treated his team members with great affection and trained them well. The question of compromising with the quality or any delay in meeting the deadlines of the publications assigned to him was just unthinkable. He had taken voluntary retirement on 31 May 1988. ❑

ANNOUNCEMENTS

Schedule of Seminars/Symposia/Get-togethers at CECRI

THE Central Electrochemical Research Institute (CECRI), Karaikudi, has organized/proposes to organize the following events during July 1997 - August 1998.

July 1997

- CECRI Foundation Day - Inauguration of Golden Jubilee Celebration - Release of CECRI Logo

August 1997

- Golden Jubilee Lectures (two)

September 1997

- Get-together with Industries: Chennai Unit
- CSIR Foundation Day - Open Day/Exhibition
- Release of a book on CECRI Patents

October 1997

- Seminar on Electroplating (Tamil) at Coimbatore SSM, Karaikudi
- Golden Jubilee Lecture

November 1997

- Get-together with Industries: Mandapam Unit
- Seminar on Electrochemicals
- SAEST, Bombay Chapter & SAEST Hq.
- Golden Jubilee Lecture

December 1997

- Seminar on Science & Human Development at Kochi (organized by FASOHD, Karaikudi)
- Get-together with Industries: Tuticorin Unit
- Golden Jubilee Lecture
- Convention of Electrochemists and Symposium on Electrometallurgy at CECRI, Karaikudi - SAEST Hq

January 1998

- Release of Golden Jubilee Souvenir
- Get-together with Industries: Kochi Unit
- Special Refresher Course on Battery Care and Maintenance

February 1998

- Golden Jubilee Lecture - Workshop on Problems of SC/ST Employees in CSIR Laboratories

March 1998

- Golden Jubilee Lecture: Chennai Unit

April 1998

- Programme by CECRI, B. Tech. students
- Workshop on Glass Blowing
- Golden Jubilee Lecture: Kochi Unit
- Special Refresher Course on Chemicals

May 1998

- Seminar/Workshop on Popularization of CSIR Technologies
- Seminar on Batteries at Karaikudi
- CECRI Staff Wards' Training Programme
- Workshop/Seminar by Administrative Staff

June 1998

- National Seminar on Corrosion Control and Metal Finishing at Kochi - NCCI
- Special Course on Metallurgy & Pollution Control
- Golden Jubilee Lecture
- Workshop on Popularization of CECRI Technologies

July 1998

- Get-together with Industries at Karaikudi
- International Symposium on Electrochemical Science & Technology, SAEST, Karaikudi. ❑

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (CSIR), NEW DELHI

POSITION: DIRECTOR, STRUCTURAL ENGINEERING RESEARCH CENTRE (SERC), GHAZIABAD

Advertisement No. 11/97

CSIR, the premier agency established by the Government of India to undertake scientific and industrial research in the country, is looking for suitable scientist/technologist for the post of Director for Structural Engineering Research Centre (SERC), Ghaziabad. SERC is devoted to undertake basic and applied research on various aspects of structural engineering, e.g. bridge engineering, tall structures, wind engineering and special structures, natural disaster mitigation and material science; to take up sponsored R&D work for public and private organizations, especially with regard to computer-aided analysis and design, monitoring of important bridges and other structures by actual field measurements, tests on special models, etc.; to develop comprehensive computer software for structural engineering applications. The major R&D programmes of the Centre are in the areas of tall and large span structures, especially on analysis and design of superstructures of bridges, their aerodynamic behaviour, performance monitoring and diagnostic of existing bridges.

The post carries the pay scale of Rs 5900-200-7300 (to be revised) plus allowance as admissible to Council officials. The appointment to the post will be on contract for a period of six years or superannuation, whichever is earlier.

For further details, please contact the Director-General, CSIR, Rafi Marg, New Delhi-110001 (INDIA), (Fax - 3710618, Telex-031- 65202 CSIR IN, 031-66147 CSIRIN, Gram-CONSEARCH, New Delhi).

Interested candidates may send their complete biodata by November 1997 to the Director-General, CSIR, Rafi Marg, New Delhi-110001.

HUMAN RESOURCE DEVELOPMENT GROUP

Advertisement No. SRF/RA-EMR-1/98

This is to bring to the attention of all concerned that CSIR has invited applications for awarding SENIOR RESEARCH FELLOWSHIPS and RESEARCH ASSOCIATESHIPS vide an advertisement appearing in 4 October 1997 issue of *Employment News*. Eligibility conditions and application proforma are published alongwith the advertisement. The application form may be cut out or copied from advertisement and used.

The last date of receiving application is 3 November 1997. The application duly completed in all respects should be sent to the Deputy Secretary, Extra Mural Research Division, Human Resource Development Group, CSIR Complex, Dr K.S. Krishnan Marg, NPL Campus, New Delhi-110 012. ❑

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit

Annual Subscription : Rs. 60
Editors : Dr B.C. Kashyap and Dr C.S. Gupta Editorial Assistant : Neelima Handoo Production : Kaushal Kishore Single Copy : Rs. 3.00
Phone : 5786301 Gram : PUBLIFORM Telex : 031-77271 E-mail: niscom@sirnetd.ernet.in. Fax : 5787062
RN 4512/57

ISSN 0409-7467

CSIR NEWS

para Jaykrishna Public Library
-Uttarpara, Dist.-Hooghly
[illegible]

Anticlockwise from top right: Dr P. S. Rao of NIO, the first Indian Scientist to reach the ocean floor (3680 m) of the Mid - Atlantic Ridge is seen on the submergence vehicle _DSV Alvin_; _DSV Alvin_ being launched for a dive; and a 40 cm long active black smoker chimney collected from the Mid-Atlantic Ridge (p. 290)

NIO Studies on Hydrothermal Mineralization

DR P.S. Rao of the National Institute of Oceanography (NIO), Goa, became the first Indian Scientist to reach the ocean floor (3680 m) of the Mid-Atlantic Ridge with deep submergence vehicle DSV *Alvin*. His dive to such a depth was to study the hydrothermal mineralization process, and it exhibited the continuation of NIO's interest in this frontier area.

Dr Rao participated in this three-week diving cruise (5-30 July) onboard the *R.V. Atlantis* alongwith 23 others from different countries, on invitation from the Rutgers University, USA. The results emanating from the analyses of various samples collected by him are expected to further up collaborative programmes with Rutgers University.

The hydrothermal vents or seafloor hotsprings are responsible for the formation of several metal rich deposits. The process of mineralization results due to the exchange of heat and chemicals between the lithosphere and the oceans. As molten rock from the earth's interior wells up and flows onto the bottom, it is solidified and has riddled faults and thermal contraction cracks. Cold seawater percolates down several kilometres through these cracks, becomes hot near the magma, and is discharged as hot springs carrying gases and metals leached from the rocks. This process significantly affects global chemical mass balances and thermal regime of the earth. The potential commercial value of the hydrothermal minerals is estimated to be enormous as some are known to have cumulative copper, zinc and lead contents up to 50%.

In 1994 survey onboard *ORV Sagar Kanya*, the scientists of NIO delineated several seamounts and submarine volcanoes along the 80 km active spreading centre and followed it up with a sampling cruise in 1995. The presence of pyrite lumps, disseminated vein- type pyrite and rocks with vents and chimney fragments have given evidences for hydrothermal activity in the region related to backarc spreading and associated volcanism. This led NIO to pursue work in hydrothermal mineralization and related aspects. ❑

NAL - UNI LECTURE SERIES

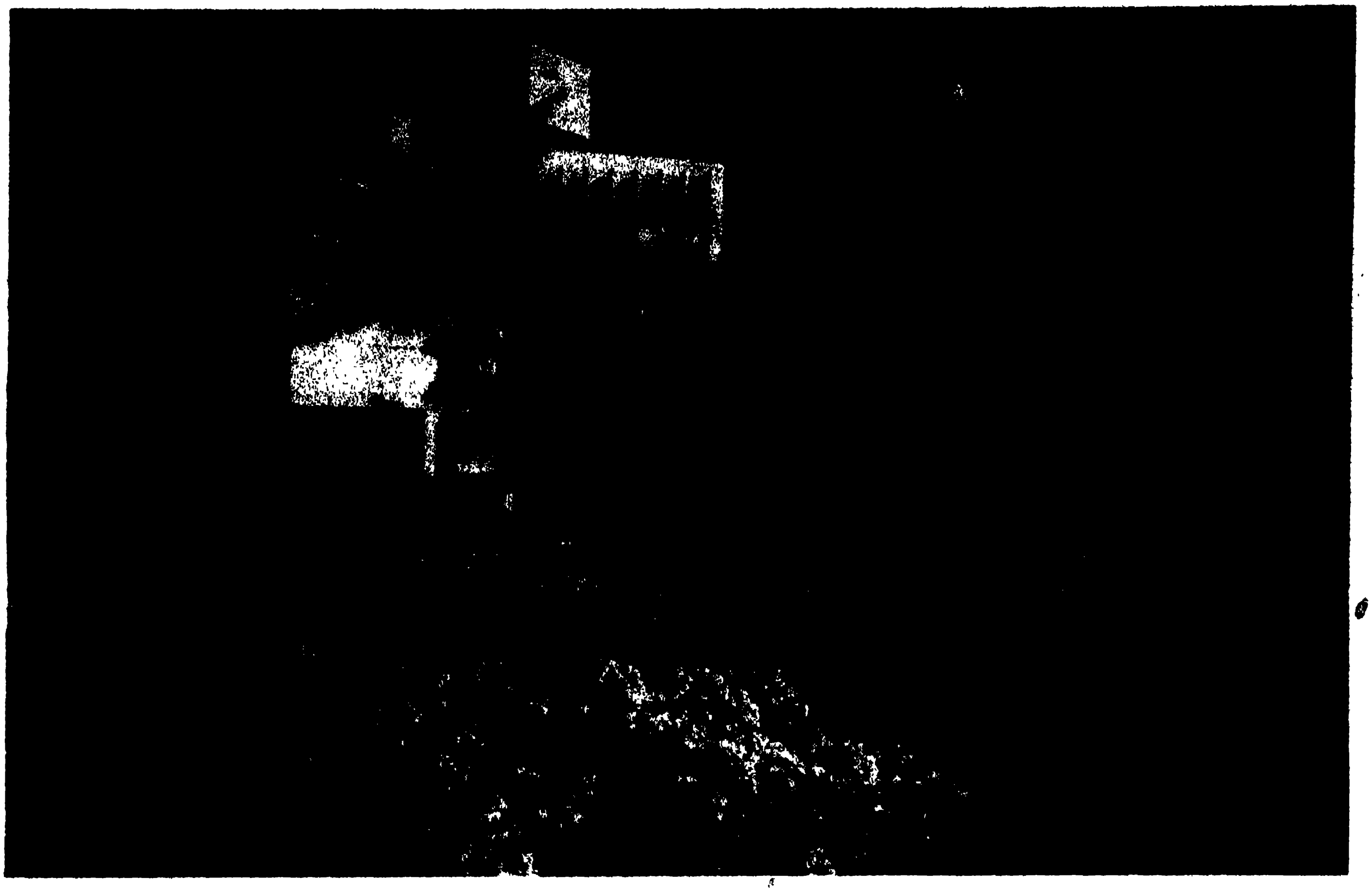
Aircraft Flight Control and Simulation

THE tenth course under the NAL-UNI Lecture series was on Aircraft Flight Control and Simulation. With 42 registrations, the course was one of the most popular and a big success as judged by participants' feedback. According to Dr T.S. Prahlad, Director of the National Aerospace Laboratories (NAL), Bangalore, one of the reasons for the success of the course was, "it did not contain textbook stuff". Instead, the course featured actual field experts from the National Control Law (CLAW) team "describing the tremendous experience of designing the control law for LCA's first flight". "We must share and pass on this experience to other control engineers in the country", Dr Prahlad said.

Inaugurating the course, Dr Kota Harinarayana shared some of CLAW experiences with the participants. "The concurrent design approach is essential in such programmes", he explained, "because you cannot build an agile, manoeuvrable, high survival, high strength fighter aircraft with good handling qualities and high reliability rates in the battle field if you work with compartmentalized disciplines".

Dr S. Srinathkumar opened the series with his "sneak preview" in which he explained why the man-machine interaction is the single most important problem in flight control law design, "we cannot forget that there's a human in the loop who can cause himself great problems during flight". The most appealing part of the course was business-like ambience the course quickly got down to. The course co-ordinators, Shyam Chetty and Padma Madhuranath, together with their colleagues, had put together a valuable but gruelling package (the course notes, with over 250 pages, over 100 illustrations and an attractively bound cover, will shortly be available for sale at Rs 500 per copy). ❑

Centre for Cellular and Molecular Biology, Hyderabad
R & D HIGHLIGHTS : 1996-97



THE Centre for Cellular and Molecular Biology (CCMB), Hyderabad, is engaged in basic research in chosen areas of modern biology and seeking potential applications thereof. Its activities range from fundamental research to work in societal and biomedical areas and interaction with universities and industry.

The Centre was established as a full-fledged national laboratory of the Council of Scientific and Industrial Research (CSIR), in 1982. In the first few years, it was housed in the buildings of the Indian Institute of Chemical Technology (IICT, then called the Regional Research Laboratory), Hyderabad. During this time, the entire building complex of the CCMB was being built in the same campus, right next to the IICT so as to be able to share research facilities and infrastructure. The staff moved into the new building complex in stages between 1984 and 1986 and it was on 26 November, 1987 that the CCMB building complex was formally dedicated to the nation and to the cause of science by the then Prime Minister and President of CSIR, the late Shri Rajiv Gandhi. Hence 26 November of every year is celebrated as CCMB Day.

This year (1996-97) is the tenth year after the dedication of the CCMB complex and this decadic year is being celebrated through a variety of activities. One of them is a series of hands-on workshops conducted at the national and international level — on Mathematical Modeling in Biology (January, 1997), DNA and Protein Footprinting (March,1997), and DNA Fingerprinting (to be held in November, 1997). The second activity has been a series of "Decadic Year Lectures", given during the twelve-month period, by eminent scientists from various parts of the world, such as Drs Asis Datta (India), Aaron Klug (UK), Inder Verma (USA), Lee Segal (Israel), R A Mashelkar (India), Akira Ishihama (Japan), P Balaram (India), M S Swaminathan (India) and Irene Maumenee Hussels (USA). The last of these lectures will be delivered by Dr James D Watson, USA on 26 November 1997. The third way we are celebrating the decadic year is through the forthcoming symposium entitled "Indian Biology in the year 2000" or **IBY2K**, in which young Indian biologists who have made a name for themselves by their research work done in India would be invited to come and present their work in the four-day symposium in late November 1997.

On this occasion of the decadic year of CCMB we look back with a sense of gratitude to the agencies and people who have supported us, with some satisfaction on what has been achieved during the ten years and look to the future with hope and renewed commitment to try and do even better as the next century beckons us. Some of the salient features of the research and development work done at the CCMB are highlighted below.

BIOMEDICINE AND BIOTECHNOLOGY

Eye Research : Molecular changes in cataract: Balasubramanian's group is attempting to identify the modifications that occur to the proteins (crystallins) that constitute the human eye lens upon ageing and during the diseased condition called cataract. At least six different pigments are seen to accumulate in the lens with time, all of which arise from modifications in the side chains of the amino acid residues constituting the crystallins, since all the pigments are found in the "insoluble" protein fractions of the cataractous lens. Some pigment can be leached out of the lens by ethanol:water extraction, which is most likely from the small molecules present in the lens cells. Apart from the kynurenines and hydroxyquinolines that this group has already identified, some other metabolites that they have seen to accumulate are methyl malonate, 2-methyl citrate, hemocysteine and cystathionine.

Using the EPR spin trapping method, it was shown that at least two of these pigments are pro-oxidants and generate oxyradicals when light is shone on them, i.e., they are photodynamic in nature. The chemical structures of several of these pigments are being elucidated using analytical spectroscopy.

Tumor Biology: Ashok Khar and colleagues are studying the mechanisms responsible for spontaneous tumor regression; their results show the participation of necrosis and apoptosis in the killing of the AK-5 tumor cells. They have also demonstrated the role of apoptosis in tumor cell death *in vivo*. It has been possible to induce apoptosis in isolated nuclei from tumor cells by extracts which contain many of the cysteine proteases and endonucleases in the activated state and have been implicated in the execution of apoptosis in a cell. They have seen the overexpression of granzyme B and Fas-ligand by the activated natural killer cells, which act as effector cells in tumor cell killing. These observations suggest that the triggering of immune cells to a state capable of inducing apoptosis, specifically in cancer cells, may have potential in cancer immunotherapy.

GENETICS AND EVOLUTION

Plant Pathogens: ***1. Fungal infection of rice*** : **Ramesh Sonti** and coworkers are involved in plant molecular biology studies of the interaction between the rice plant and the bacterial pathogen *Xanthomonas oryzae* (Xoo). They had previously reported DNA fingerprinting data, which indicated that a single lineage of Xoo is widely distributed in India. They have now found that this lineage can also be isolated from wild rice plants, which are native to India and located away from cultivated rice plants. This suggests that this epidemiologically important Xoo lineage is also native to India.

In collaboration with **Balasubramanian's** group they have shown, using *in vivo* and *in vitro* assays, that the membrane-bound, yellow, bromocarotenoid pigment called xanthomonadin, present in Xoo, provides endogenous antioxidant protection against photobiological damage.

Several transposon-induced Xoo mutants that are deficient in extracellular polysaccharide (EPS) production and virulence have been isolated and the regions flanking the sites of transposon insertion have been cloned for further analysis. Xoo mutants that are EPS-proficient but virulence-deficient have also been identified after chemical mutagenesis. Some of these mutants are amino acid auxotrophs while others are being characterized in order to determine the nature of the virulence deficiency.

2. Microbial resistance to plant antibiotics: **Durgadas Kasbekar** and colleagues are studying how cellular slime moulds and filamentous fungi adapt themselves to tolerate antibiotics. Their research has focussed on two antibiotic resistance mechanisms; one, an inducible resistance to isoflavanoid phytoalexins from leguminous plants (e.g. pisatin from pea) and the other, an inducible resistance to the polyene antibiotic nystatin. Although these two mechanisms are distinct, they share a curious relationship in that, cellular slime mould amoebae that have been grown on pisatin-medium become more proficient at acquiring cross-resistance to nystatin.

These results suggest that the amoebae respond to isoflavanoids altering their sterol composition and thereby become resistant to these compounds. These sterol alterations might also account for their ability to become cross-resistant to nystatin. It is well known that the cytotoxic effect of nystatin depends on its binding to membrane sterols; the sterol-antibiotic complex forms aqueous pores through which cell contents leak out resulting ultimately in cell death. It appears that the isoflavanoid-induced sterol alterations result in fewer nystatin-sterol complexes. This would allow the cells to survive nystatin's cytotoxic effect longer and thereby facilitate the turning on of a nystatin- dependent nystatin-resistance mechanism.

Consistent with this model, cells transferred from isoflavanoid to nystatin-medium have the same sterol composition as cells from normal medium. In other words, after the nystatin-dependent nystatin-resistance is turned on, there is no further need to maintain the isoflavanoid-induced sterol changes; thereafter, the resistance phenotype is maintained by the nystatin in the medium.

Genetics of osmoregulation in microorganisms: J Gowrishankar and coworkers have shown *Salmonella typhimurium* to have a cryptic P1 promoter for the *proU* operon that is transcribed by RNA polymerase holoenzyme bearing the stationary-phase sigma factor; crypticity was demonstrated to be a consequence of transcription termination (attenuation) a short distance downstream of the promoter, which could be relieved by deletion of the attenuator site.

Adaptive or directed mutations in bacteria: Manjula Reddy and **Gowrishankar** have designed a genetic strategy to examine the occurrence of mutations in stationary phase populations. In this strategy, a parental population of cells is able to survive under both permissive and restrictive conditions whereas mutants at a particular target locus exhibit a conditional-lethal phenotype. Thus, by growing the population to stationary phase under restrictive conditions and then shifting it to permissive conditions, mutations that had arisen in stationary phase can be studied without confounding effects caused by the occurrence of similar mutations during growth of the population. In two different applications of this strategy, the reversion to Lac$^+$ in stationary phase of several Lac$^-$ mutations in *Escherichia coli* was studied. The results indicate that a variety of spontaneous point mutations and deletions, particularly those that are sensitive to the mechanisms of replication slippage (for their generation) and methyl-directed mismatch repair (for their correction), can arise in nondividing populations of cells within a colony. The frequency of their occurrence was also elevated in *mutS* strains, which are defective in such mismatch repair. These data have relevance to the ongoing debate on adaptive or directed mutations in bacteria.

Psychrotrophy: Cold-adaptation in bacteria: S Shivaji, Malay Ray and coworkers have proposed a temperature sensing mechanism which is crucial to the adaptive response of psychrotrophic bacteria from Antarctica for adjustment to environmental temperatures. This proposal is based on the correlation that they see in the phosphorylation and dephosphorylation pattern of membrane proteins with the environmental temperature both *in vitro* and *in vivo*. The discovery of a tyrosine kinase activity and two tyrosine phosphorylated proteins in the cytoplasm of *P. syringae* is also interesting since this so-called 'eukaryotic enzyme' might shed light on the origin and evolution of the enzyme and the role it plays in bacterial physiology.

Characterization of the Plague bacillus: *Yersinia pestis* was identified as the causative organism of plague in India in 1994, based on microbiological, clinical and serological evidences and on the presence of *f1* and *pla* genes which are molecular markers of *Y.pestis*. However, these studies did not reveal whether the isolates were identical to one another and also whether they were similar or identical to already existing strains of *Y.pestis*. For this purpose, **Shivaji** and coworkers carried out DNA ribotyping, and DNA amplification fingerprinting using arbitrary primers and 16S rRNA gene sequencing of seventeen isolates of *Y.pestis*. The results based on their ribotype and RAPD profiles unambiguously establish that all the isolates are identical. Further, their 16S rRNA sequences were highly homologous and exhibited 95 to 99% identity with the sequence of the type strains of *Y. pestis* available in the gene database.

Genetics of development: Body plan of the fruit fly: L S Shashidhara and colleagues are attempting to understand morphogenetic mechanisms that are used to regulate segment-specific developmental pathways. The identity of every segment in *Drosophila* is determined by the action of one or more homeotic selector genes. The structure and function of these genes are highly conserved across a wide range of animals. They have already shown that the homeotic gene *Ultrabithorax (Ubx)* generates differences between wing and haltere by regulating the expression of certain wing patterning genes such as *vestigial, cut wingless, distal-less* and *scabrous* in the haltere discs. Their results highlight the importance of *Ubx* mediated growth control during haltere morphogenesis.

Their study also includes identification of new genetic markers to study segment-specific morphogenesis. Earlier, they had screened a number of GAL4 enhancer-trap lines for their segment-specific expression patterns in the ventral nerve cord and imaginal discs. They did detailed genetic characterization of one such line, which suggests that, the identified gene functions in a genetic pathway that regulates growth during wing and leg development. Further genetic and molecular characterization of this gene is in progress.

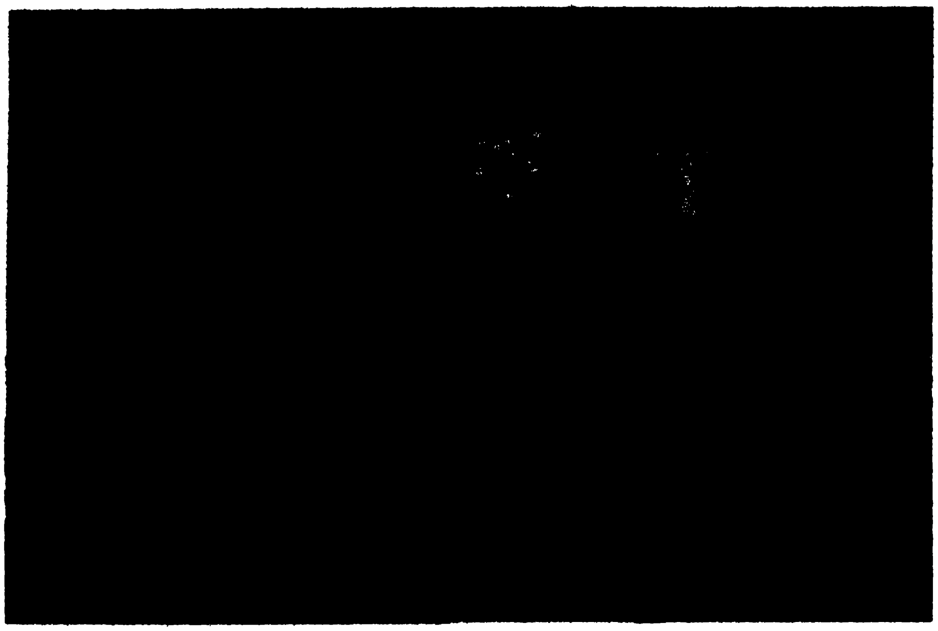
Human genetics: Unique case of sex reversal: Lalji Singh and his colleagues are continuing their studies on sex determination. They found a unique case of sex reversal in a XXY female. Individuals with Klinefelter syndrome (47, XXY), one of the most common sex chromosome associated abnormalities, are sterile phenotypically, males. They reported, for the first time, a unique case of sex reversal in an individual having the chromosome constitution (47, XXY).

Human genetic diversity analysis: Molecular studies on human diversity done by the same group, shows that the Y chromosome is useful for the study of human paternal lineage because it is uniparentally inherited and escapes from recombination along most of its length. Analysis of DNA polymorphism allows the construction of haplotypes which can be used to build trees of Y chromosomes, and comparison of the frequencies of these haplotypes in different populations gives information about population histories and relationships. Their study of Y-specific microsatellite and other haplotyping data suggest the existence of at least two new classes of deletion.

CELL BIOLOGY AND DEVELOPMENT

Modulation of sperm motility: S Shivaji and coworkers have earlier demonstrated that acquisition of motility by mammalian spermatozoa during epididymal maturation could be attributed to increase in phosphorylation of sperm membrane proteins at the tyrosine residues. The membrane associated protein tyrosine kinase has since been purified 200-fold and it was observed that its activity was seen to be significantly stimulated in the presence of vanadate, an inhibitor of protein tyrosine phosphatase. These results taken together would imply that if an increase in protein tyrosine phosphorylation is crucial for spermatozoal motility, then inhibiting protein tyrosine phosphatase should result in an increase in motility. Preliminary studies indeed demonstrate that inhibitors of protein tyrosine phosphatases such as vanadate and calyculin increase the motility of spermatozoa.

Epithelial cell behaviour: P D Gupta and colleagues have been engaged in studying various aspects of epithelial cell biology under influence of hormones or under stress in different systems. This year, they have identified the existence of circadian rhythms in the functioning of intes-



Looking at cells through the confocal microscope

tinal epithelial cells and in the division and death cycle of cells in the epithelial layer of villus. D-glucose transport across the brush border membrane of villus shows enhanced activity at night, which coincides with the feeding time. Though the rats have a round the clock supply of feed, most of the feeding takes place around that time. Growth pattern also shows a diurnal pattern with proliferation markers appearing in the morning, division in the evening and apoptosis late in night.

In studies on vaginal epithelial cells, they attempted to identify membrane receptors to explain the generation of second messengers and pleiotropic effects of estradiol on its target tissue. Studies were carried out on apoptosis of epithelial cells in various systems such as vaginal epithelial cells and the thymus by monitoring parameters like transglutaminase activity, cell death marker genes and DNase activity.

Heat shock response: Usha Srinivas and coworkers are attempting to understand how stress is sensed by cell/tissue leading to the synthesis of specific stress proteins. Using fluorescent probes that position differently in the plasma membrane bilayer, they showed that the composition of the plasma membrane changes within minutes of imposition of heat stress to the cell. They also demonstrated a mild acidification of cytoplasmic *p*H upon heat shock. The second aspect of their study is to see how this stress signal is transduced into the interior of the cell/tissue. Using activators and inhibitors of kinases, they could demonstrate a role for protein kinase C in the interaction between the heat shock factor protein the heat shock element, and could show tyrosine phosphorylation to be involved in signal transduction during early stages of heat shock response. Studies to identify the particular kinase that specifically gets activated during heat shock are in progress.

Muscle growth and regeneration: Jyotsna Dhawan and **Chetana** are interested in understanding the molecular biology of skeletal muscle growth and regeneration. They are attempting to identify and isolate genes that are specifically expressed in the satellite myoblasts, the cell type responsible for regenerative ability of skeletal muscle. They have shown that primary mouse myoblasts can be reversibly growth arrested by methylcellulose suspension culture, providing an *in vitro* model for the quiescent satellite cell. In preliminary studies using differential display of mRNA, they have identified a cDNA fragment that detects a mRNA whose expression appears to be restricted to the quiescent state. Current efforts are aimed at identifying a number of such genes, which will be subsequently screened for their ability to detect quiescent satellite cells *in vivo*.

Modelling spatially-extended systems using coupled map lattice systems: Most natural systems have components that are organised spatially and temporally through many types of interactions. Examples are excitable heart cells or neural tissues interacting through electrical or chemical coupling, or, a metapopulation where large number of population patches are coupled through migration. Such coupled systems can be modelled using *Coupled Map Lattices* (CML) which assumes sites on a lattice (one- , two-, or three-dimensional) having its own local dynamics which is modified by interactions with its neighbour. These CML systems are capable of showing many interesting spatiotemporal dynamics including chaos depending on the local dynamics and interaction strength. In general, the regular, normal dynamics exhibited by such a spatially-extended system can be changed to irregular or chaotic due to mutation, disease or environmental perturbations. Thus it is not only important to know the detailed dynamic behaviour of these model systems, it is also necessary to be able to control the abnormality when it arises.

Somdatta Sinha and S Parthasarathy have studied CML systems with different forms of local dynamics and observed that nearest-neighbour coupling can influence the local dynamics considerably. For example because of regular migration among different population patches (sites in the CML), individual sites show very different dynamics (stable, periodic or chaotic) even when all the sites have the same growth rate, and can thus respond differently to a global ecological disturbance. They have also developed a method to control the dynamics of this system to any desired state (periodic or stable), and suppress complex dynamics in the entire lattice or in a group of sites only. This method can be a candidate mechanism for suppressing undesirable dynamics in pathological activities (e.g., the appearance of ectopic pacemakers, or localised lesions).

MOLECULAR BIOLOGY

Lamin gene regulation: Veena Parnaik and her colleagues are interested in understanding the mechanism of regulation of the lamin A gene, which is expressed only in differentiated cells. They have delineated a region of the lamin A proximal promoter, which is essential for the activity of a reporter gene in transient transfection studies in cultured cells. This region contains binding motifs for the Sp1 and Ap1 transcription factors. Specific DNA-protein interactions at these sites have been demonstrated by DNase I footprinting studies and electrophoretic mobility shift assays.

Nuclear pore complex This same group had earlier identified a 60 kDa nuclear pore protein that is required for protein transport into the nucleus. This protein is observed to be specifically phosphorylated at serine/threonine residues during mitosis in cultured fibroblast cells and is rapidly dephosphorylated upon release of cells from mitosis into the G1 phase of the cell cycle, concomitant with the reassembly of the nuclear envelope. This novel finding suggests that phosphorylation of pore proteins followed by their dephosphorylation may be essential for the disassembly and reassembly of the nuclear pore complex during mitosis.

Transcription in *E. coli*: Dipankar Chatterji and **Kakoli Mukherji** have been studying the omega subunit of the multisubunit DNA-dependent-RNA polymerase of *Escherichia coli,* which is ubiquitously present in all preparations of the enzyme. However, this polypeptide of 91 amino acids has no known physiological function. Strains lacking omega are viable, suggesting its *in vitro* non-essentiality; RNA polymerase reconstituted from purified subunits in the absence of omega is functional *in vitro*. Nevertheless, omega binds stoichiometrically to RNA polymerase, cross-links specifically to the β′-subunit, and is immunologically conserved among bacteria.

In order to elucidate the function for the ω-subunit, they purified it to very high purity from an overexpressing strain [BL21(pGP1-2, pE3C-2)] and used it for reconstitution with RNA polymerase isolated from an omega-less strain (CF2790). The omega-less strain grows significantly slower than the wild type and correspondingly the omega-less RNA polymerase has less than 50% activity of its wild-type counterpart. This enzyme also has little affinity for heparin-Sepharose, indicating an altered DNA-binding ability. Renaturation of the denatured omega-less enzyme is enhanced in the presence of molar excess of omega. It has been further observed that under normal growth conditions, omega is expressed at higher levels at the late log/stationary phase in a wild-type strain. Upon temperature shift (low/high) or with a change in the carbon source, the omega level is elevated throughout the growth cycle. Another independent observation indicates that the omega-less RNA polymerase is associated with high levels of GroEL as compared to the wild-type enzyme. This suggests that omega might have more of a structural than a functional role and may act as a "chaperone" or "scaffold" to assist RNA polymerase folding.

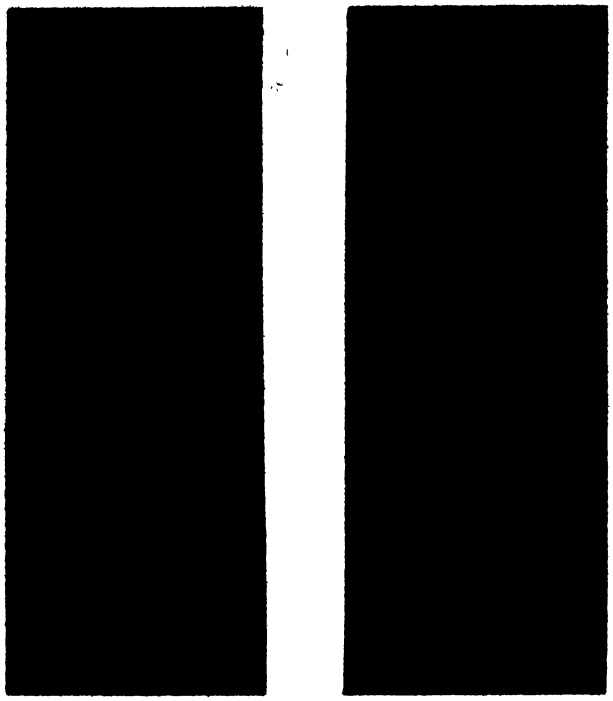
Stringent response: Under nutritional stress, *E.coli* exhibits an adaptive facility termed the "stringent response" that involves, *inter alia*, the negative regulation of rRNA synthesis that is mediated by ppGpp – a nucleotide analog known as stringent factor. To elucidate the mechanism of action of ppGpp, **Chatterji** and **Arvind Raghavan** first showed that it cross-links to the C-terminal domain of β-subunit of *E.coli* RNA polymerase. Kinetic and biophysical studies indicated that ppGpp destabilizes transcription complexes at stringent promoters, inducing the release of the σ-subunit from the complex, while no such effect was seen at non-stringent mRNA promoters. They have concluded that such destabilization is perhaps the basis for the negative regulation of rRNA synthesis under nutritional stress.

Studies on regulation of cell growth: Ghanshyam Swarup's group has been focusing attention on events in the cell cycle and studying cell cycle regulated protein tyrosine phosphatases. PTP-S2 is a nuclear protein tyrosine phosphatase, which shows increased expression upon mitogenic stimulation of a variety of mammalian cells. In order to analyze the role of this protein in cell division, stable clones of HeLa and NIH 3T3 cells were isolated. PTP-S2 overexpressing cells showed increased growth rate, lower serum requirement and loss of contact inhibition. These results suggest that PTP-S2 is a positive regulator of cell growth in transformed as well as non-transformed cells.

An enzymatically inactive mutant of PTP-S2 was made by replacing a cysteine with serine residue at the active site. This mutant PTP-S2 upon transfection in NIH 3T3 cells increased the rate of cell proliferation. These results are consistent with the suggestion that PTP-S2 dephosphorylates and inactivates a negative regulator of cell proliferation. The inactive mutant of PTP-S2 may be inactivating the negative regulator by physically associating with it.

BIOCHEMISTRY AND BIOPHYSICS

Chaperone-like activity of a lens protein: During this decade, there has been an increased interest and activity in the problem of protein folding, because of its importance in biotechnology and also because of the recent recognition that defective protein folding is the molecular basis for a growing list of human diseases. Molecular chaperones mediate the correct folding and assembly of several proteins in the cell. Understanding the molecular details of the chaperoning process is necessary to devise strategies to control several diseases and also to enhance the yield, solubility and stability of engineered proteins. **Ch Mohan Rao's** group is investigating the chaperone-like activity of the lens cortical protein α-crystallin. They believe that the failure of α-crystallin function may lead to lens opacification. By using a non-thermal aggregation mode, it was possible for them to discover the temperature dependence of the chaperone-like activity of α-crystallin. They suggest that α-crystallin functions by providing hydrophobic surfaces and a structural transition in the protein above 30°C enhances this activity. By studying the structural aspect of α-crystallin at different temperatures, and under different conditions, they could identify quaternary and tertiary structural perturbations in the molecule, which lead to a concomitant increase in the hydrophobicity. This, perhaps, is the basis for the enhanced activity



The "chaperone" action of the lens protein molecule α-crystallin (A → B)

of α-crystallin. Their studies using carbonic anhydrase, lactalbumin, lysozyme and RNase A as target proteins have showed that α-crystallin exerts its chaperone-like function by binding to the aggregation-prone molten globule state of the target protein.

Fluorescence probing of membranes. Amit Chattopadhyay and colleagues are attempting to understand the role of tryptophan residues in the structure and function of membrane proteins. Tryptophan octyl ester (TOE) is a useful model for membrane-bound tryptophan residues. They have characterized this molecule as a fluorescent membrane probe in terms of its ionization, partitioning and motional characteristics in unilamellar vesicles of dioleoylphosphatidylcholine. The ionization property of this molecule in model membranes has been studied by utilizing its *p*H-dependent fluorescence characteristics. Their results suggest that TOE should prove useful in monitoring the organization and dynamics of tryptophan residues incorporated into membranes.

Designing antimicrobial peptides: *1. Use of p-fluorophenylalanine in peptide synthesis:* In an effort to generate short peptides with potent, selective antimicrobial activity, **R Nagaraj** and colleagues have examined the effect of introducing the unnatural amino acid p-fluorophenylalanine (PfF). Peptides with PfF showed broad-spectrum antimicrobial activity against gram negative and gram positive microorganisms, as well as fungi, as compared to the parent peptide without this amino acid.

2. Defensin peptides: Defensins are 40-residue mammalian host-defence peptides. Smaller peptides composed of 18-26 residues corresponding to the β-hairpin region of defensin NP-2 were seen to display good antimicrobial activity; they believe that peptides corresponding to the β-hairpin region could be a good tool to investigate the various other biological properties of defensins.

Hydrotropes —a class of self-assembling molecules: Hydrotropes are a class of compounds that are widely used in chemical, cosmetic, and pharmaceutical industries. Though amphiphilic in character, they have shorter hydrophobic regions and thus differ from classical surfactants. Yet they display substantial (and often selective) ability to solubilize lipophilic compounds in water. Beyond the minimal hydrotropic concentration, these molecules self-aggregate to produce the operating assembly. **Balasubramanian** and **V Srinivas** have shown, based on crystal structure analysis of several hydrotropes, that these compounds form open-layer assemblies (reminiscent of lamellar liquid crystals), consisting of alternating hydrophobic clustering of the nonpolar regions adjacent to ionic or polar regions that are knitted together in a two-dimensional network. Stacking of aromatic rings is not seen. Two types of assemblies are seen, one with a more open and extended hydrophobic layer than the other. Solubilizates enter the hydrophobic layers of microunits producing a cooperative and mutual stabilizing effect. The observed open layer structure of hydrotropes might also account for the occasional ability of these compounds to solubilize even better than micelles.

APPLIED FRONT

Several projects of applied and developmental nature were taken up during the year.

Commercially important tool for protein production by genetic engineering: J Gowrishankar and associates have exploited the salt inducible *proU* promoter for the construction of an expression strain in which it is possible to induce the production of a protein from a target gene by using common salt as the inducer.. It is seen to perform better than the currently popular IPTG-inducible expression vector system, and to produce substantially lower amounts of the insoluble protein "inclusion bodies". This salt-inducible expression vector system has been licensed to an Indian company for assessment of capability to produce genetically engineered alpha-2 interferon. Shortly it may be licensed to an overseas firm for commercial sales of this technology to researchers around the world.

Hepatitis B Vaccine: A small biotechnology firm, which had the technology for laboratory scale production of the hepatitis B viral antigen through genetic engineering, approached CCMB for technical advice and help in optimizing the protocol and for large scale production of the vaccine. **K S N Prasad** of the Centre was directly involved in providing such technical advice and consultancy to them. Based on this, the firm was able to produce the material and sent it through clinical trials with success. The company has now launched the hepatitis B vaccine in the market.

RNasin: inhibitor of ribonuclease: A constant problem facing an experimenter who handles nucleic acids is that of degradation of RNA by the ubiquitously present enzyme ribonuclease (RNase). It becomes important to use inhibitors that abolish or greatly reduce RNase action. Such an inhibitor called RNasin is commercially available and extensively used. **Ravi Sirdeshmukh, B S N Murthy** and **Vijayarangam** have developed an efficient method to isolate and prepare in the pure form, in large quantities, RNasin from discarded human placenta. This preparation was given to a commercial firm for market analysis, survey and technology transfer. Having found this RNasin to be an excellent cost-competitive inhibitor, the firm has now entered into an agreement with CCMB for technology transfer and commercial production of this molecular biological.

Wildlife management. Concern about wild and endangered species has increased due to a sudden and significant increase in the number of extinct species. Apart from extraneous factors such as poaching and habitat degradation which may contribute to this plight, it is also possible that there is a decrease in the reproductive capabilities of these animals. **Shivaji** and coworkers have standardized protocols for collection of semen from lions, tigers, leopards and other wild animals and analyzed these samples with respect to sperm count, viability, motility, morphology and fertilizing ability by *in vitro* fertilization. Studies have so far been completed on the lions, tigers and leopards of three zoos in India and the results indicate that many of the animals exhibit normal semen profiles and could be used successfully in breeding programmes. Attempts are now in progress to create a sperm and oocyte bank for these endangered animals so as to facilitate assisted reproduction methods such as intrauterine insemination and embryo transfer as and when required.

Field study of the reproductive biology of wild animals

Earlier reports of **Lalji Singh** and his colleagues have suggested that Asiatic lions and tigers are highly inbred and show no variation at all and therefore are likely to become extinct in near future. Their study of these species has shown significant genetic variation. By microsatellite analysis they have been able to discriminate pure Asiatic lions from the hybrids between Asiatic and African lions. Similarly they have also been able to distinguish between Siberian and Indian tigers and their hybrids. In order to ascertain the variation, which existed at the turn of the present century, they performed microsatellite analysis on 125 year-old skin samples from museum specimens, which showed similar levels of genetic variability as in the present population. This suggests that the low genetic variability may be a characteristic feature of these species and not the result of intensive inbreeding. DNA fingerprinting studies of Asiatic lions and tigers have helped in identifying individuals with high genetic variability, which could be used for conservation breeding programmes.

Method for protein estimation **P D Gupta** and **A A Waheed** have developed a new technique using eosin B for estimation of proteins. This appears to be potentially of use in the quick quantification of protein levels by spectrometry. They have further looked into the mechanism of the dye eosin binding to protein and found that the carboxylic and phenolic groups of the dye bind electrostatically to arginine, histidine, lysine residues and at acidic pH to tryptophan.

Enzymology on foams and beads: The fact that certain enzymes, e.g., lipases, are active in organic solvents has interested chemists in using enzymes in organic reactions. Lipases are interfacially active enzymes and the nature of the interface has a bearing on the reaction efficiency. **N Madhusudhana Rao** has experimented with two reaction media wherein the disadvantages of using organic solvents are reduced. In aqueous foams of substrates, lipase efficiently catalyses esterification. In foams the lipase substrates form an insoluble monolayer, which is presented to the enzyme for efficient product formation. The rates of ester formation are faster here than in neat substrate solutions. Preliminary data confirm the stereoselective nature of the synthesis. In the second strategy, the reactions are performed in water on substrate, that is adsorbed on inexpensive hydrophobic beads. Both the methods are novel and appear to be efficient.

INTERACTION WITH INDUSTRY

The Centre holds periodic "CCMB-Industry Get-togethers" in which people from chemical, biological, pharmaceutical and agricultural firms come and discuss matters of mutual interest. At the last meeting, we presented three different case studies of our fruitful experience with industry: first, with a small scale biotechnology firm, Shantha Biotechnics Pvt. Ltd, Hyderabad who had the technology for the laboratory scale production of a vaccine, whom we helped through technical advice and consultation in establishing the right protocol and for the scale-up to large scale production; the second is our experience with Dr Reddy's Research Foundation whom we helped through two specific technology tie-ups wherein their scientists came and worked in our laboratory for a period of time and took away the methodology and protocol that would help them; the third was to interact with the small biotechnology firm Bangalore Genei about an enzyme inhibitor that we had made in the laboratory which, after they tested and surveyed it, has been taken by them for commercial production and sales. This presentation has led to further viable and productive interaction with more biotechnological and agricultural firms.

UNIVERSITY CONNECTION

CCMB is formally identified as an out-station research link of the Jawaharlal Nehru University, New Delhi and offers a

Participants of the Indo-Japan Workshop on DNA and protein footprinting

doctoral degree research programme on their behalf. The Centre has been attracting a large number of doctoral degree students, post-doctoral fellows, summer trainees and young associates from within the country as well as other nations such as USA, Japan, the Czech Republic, China, Mauritius, the Netherlands, England and Germany. The strength of post-doctoral research fellows from within the country has increased significantly and the Centre has now more than 40 of them, adding their experience and enthusiasm to our efforts. CCMB's programme of summer trainees has been particularly gratifying with students from all over the country coming and spending the summer months with us.

RESEARCH PERFORMANCE DATA –1996-97

Papers published

1. **Aggarwal, R.K., Brar, D.S., Huang, N.** and **Khush, G.S.** (1996). Differentiation within CDD genome species in the genus *Oryza* as revealed by total genomic hybridization and RFLP analysis. *Rice Genetics Newsletter,* 13: 54-57.

2. **Azhar, M., Manogaran, P.S., Kennady, K., Pande, G.** and **Nanjundaiah, V.** (1996). A Ca^{2+}-dependent early functional heterogeneity in amoebae of *Dictyostelium discoideum,* revealed by flow cytometry. *Experimental Cell Research,* 227: 344-351.

3. **Brar, D.S., Daimacio, R., Elloran, R., Aggarwal, R., Angeles, R.** and **Khush, G.S.** (1996). Gene transfer and molecular characterization of introgression from wild *Oryza* species into rice. Molecular genetic studies of the bacterial blight pathogen of rice in India. In: *Proceedings of the Third International Rice Genetics Symposium,* in Rice Genetics III: pp.477-486

4. **Cashikar, A.G.** and **Rao, N.M.** (1996). Role of intersubunit disulphide bond in the unfolding pathway of dimeric red kidney bean purple acid phosphatase. *Biophysica et Biochimica Acta,* 1296: 76-84.

5. **Chattopadhyay, A., Rukmini, R.** and **Mukherjee, S.** (1996). Photophysics of a neurotransmitter: ionization and spectroscopic properties of Serotonin. *Biophysical Journal,* 71: 1952-1960.

6. **Chattopadhyay, A.** and **Harikumar, K.G.** (1996). Dependence of critical micelle concentration of a zwitterionic detergent on ionic strength: implications in receptor solubilization. *FEBS Letters,* 391: 199-202.

7. **De, P.K.** (1996). Sex-hormonal regulation of 20.5 and 24 kDa major male-specific proteins in Syrian hamster submandibular glands. *Journal of Steroid Biochemistry and Molecular Biology,* 58: 183-187.

8. **Deshpande, N., Chopra, A., Rangarajan, A., Shashidhara, L.S., Rodrigues, V.** and **Krishna, S.** (1997). The human transcription enhancer factor-1, TEF-1, can substitute for *Drosophila scalloped* during Wing-blade development. *Journal of Biological Chemistry,* 272: 10664-10688.

9. **Devi, U.K., Ahmad, B.M.** and **Shivaji, S.** (1996). Acrosome membrane associated protein kinase activity in hamster spermatozoa. *FEBS Letters,* 396: 123-126.

10. **Dhawan, J., Rando, T.A., Elson, S., Lee, F., Stanley, E.R.** and **Blau, H.M.** (1996). Myoblast-mediated delivery of macrophage colony stimulating factor (CSF-1) in the cytokine-deficient osteopetrotic (op/op) mouse. *Somatic Cell and Molecular Genetics,* 22: 363-381.

11. **Gopal, V.** and **Chatterji, D.** (1997). Mutations in the 1,1 subunit of *E. coli* σ^{70} and disruption of its overall structure. *European Journal of Biochemistry,* 244: 613-618.

12. **Gouri, B.S.V.** and **Swarup, G.** (1997). Interaction of SH3 domain of Hck tyrosine kinase with cellular proteins containing proline rich regions: evidence for modulation of unique domain. *Indian Journal of Biochemistry and Biophysics,* 34: 29-39.

13. **Guha, S., Rawat, S.S., Chattopadhyay, A.** and **Bhattacharyya, B.** (1996). Tubulin conformation and dynamics: a red edge excitation shift study. *Biochemistry,* 35: 13426-13433.

14. **Gupta, A., Malati, T.** and **Gupta, P.D.** (1997). Differential reduction in the expression of keratin polypeptides in human gastric carcinomas. *Cancer Detection and Prevention,* 21: 129-134.

15. **Gupta, P.D.** and **Nandini, R.** (1996). Hormones, cytoskeletal proteins and cell shape. *Current Science,* 71: 737-745.

16. **Gupta, P.D., Nandini, R.** and **Rao, K.S.** (1996). Hormone induced changes in cell shape. Role of cytoskeletal proteins. *Cytobios,* 86: 75-111.

17. **Hamid, Q.A., Thanumalayan, S.** and **Parnaik, V.K.** (1996). An improved method to distinguish micrococcal nuclease sensitivity of chromatin. *Journal of*

HONOURS AND AWARDS

Ms Rana Anjum
- Won the Best Poster Award of Society of Biological Chemists, India (SBCI), 1996

Prof D Balasubramanian
- Elected as Fellow of the American Association for the Advancement of Science, Washington, USA (FAAAS)
- Awarded 10th Kharazmi International Festival Award, IROST, Tehran, Iran
- Invited to deliver the 13th Convocation Address, Madurai Kamaraj University, Madurai
- Invited to deliver the Second Prof McBain Memorial Lecture of NCL Research Foundation at National Chemical Laboratory, Pune
- Invited to deliver "The Third Annual Lecture" of The Ranganathan Centre for Information Studies, Chennai

Dr D Chatterji
- Visiting Professor, Johns Hopkins University, USA
- Elected as Fellow, Indian National Science Academy (FNA)
- Elected as Honorary Senior Fellow, J N Centre for Advanced Scientific Research, Bangalore

Dr Amitabha Chattopadhyay
- Awarded the Raman Research Fellowship, CSIR, New Delhi

Dr P K De
- Awarded the Wellcome Trust Travel Grant for the year 1996

Dr J Gowrishankar
- Awarded the Raman Research Fellowship, CSIR, New Delhi
- Elected as Honorary Senior Fellow, J N Centre for Advanced Scientific Research, Bangalore

Dr P D Gupta
- Elected as Fellow, the Society of Cytologists and Geneticists, India

Ms V Krishnakumari
- Won the Best Poster Award of SBCI,1996

Dr Ch Mohan Rao
- Won the Sreenivasayya Memorial Award, SBCI, 1996
- Visiting Professor, Tokyo Science University, Japan

Mr S Nambirajan
- Won the Krishnamurthy Award of SBCI, 1996

Dr Veena K Parnaik
- Visiting Scientist, Osaka University Medical School, Japan

Mr B Raman
- Won the INSA Young Scientist Award, 1996

Dr K Sridhara Rao
- Visiting Scientist, The Tokyo Metropolitan Research Institute of Medical Sciences, Tokyo, Japan

Dr M K Ray
- Awarded the Monbusho Visiting Scientist Fellowship, NIBB, Okazaki, Japan

Ms A Sharadadevi
- Won the Best Poster Award of SBCI, 1996

Dr S Shivaji
- Visiting Scientist, National Institute of Basic Biology (NIBB), Okazaki, Japan

Dr Lalji Singh
- Awarded the Haldane Oration Medal, Society for Bionaturalists, India
- Awarded the Jagdish Chandra Bose Award for Research in Life Sciences, Hari Om Ashram Trust.

Dr Somdatta Sinha
- Elected as Fellow, National Academy of Sciences of India (FNASc)

Dr Ghanshyam Swarup
- Won the Shanti Swarup Bhatnagar Prize in Biological Sciences, 1996.

Ms Bhavna Tiwari
- Won the Prof Seshachar Memorial Award for the Best Poster at the Indian Society of Cell Biology Conference, Mumbai, Jan.1997

Biochemical and Biophysical Methods, 33: 59-64.

18. **Hamid, Q.A., Fatima, S., Thanumalayan, S.** and **Parnaik, V.K.** (1996). Activation of the lamin A gene during rat liver development. *FEBS Letters,* 392: 137-142.

19. **Jagannadham, M.V., Chattopadhyay, M.K.** and **Shivaji, S.** (1996). The major carotenoid pigment of a psychrotrophic Micrococcus roseus strain: fluorescence properties of the pigment and its binding to membranes. *Biochemical and Biophysical Research Communications,* 220: 724-728.

20. **Jagannadham, M.V., Narayanan, K., Rao, Mohan Ch.** and **Shivaji, S.** (1996). *In vivo* characteristics and localisation of carotenoid pigments in psychrotrophic and mesophilic *Micrococcus roseus* using photoacoustic spectroscopy. *Biochemical and Biophysical Research Communications,* 227: 221-226.

21. **Jobling, M.A., Samara, V., Pandya, A., Fretwell, N., Bernasconi, B., Mitchell, R.J., Gerelsaikhan, T., Sashnyam, B., Sajantila, A., Salo, P.J., Nakahori, Y., Disteche, C.M., Thangaraj, K., Singh, L., Crawford, M.H.** and **Tyler-Smith, C.** (1996). Recurrent duplication and deletion polymorphisms on the long arm of the Y chromosome in normal males. *Human Molecular Genetics,* 5: 1767-1775.

22. **Joseph, M.** and **Nagaraj, R.** (1996). Acylation of proteins: recent advances. *Indian Journal of Biochemistry and Biophysics,* 33: 343-348.

23. **Joseph, M.** and **Nagaraj, R.** (1997). Is the role of fatty acids only to provide membrane-anchor in fatty acylated proteins? *Indian Journal of Biochemistry and Biophysics,* 34: 1-5.

24. **Kamatkar, S., Radha, V., Nambirajan, S., Reddy, R.S.** and **Swarup, G.** (1996). Two splice variants of a tyrosine phosphatase differ in substrate specificity, DNA binding and subcellular localization. *Journal of Biological Chemistry,* 2071: 26755-26761.

25. **Khar, A.** (1997). Role of cytokines in modulating NK cell function leading to spontaneous tumor regression. *Immunomodulation,* (ed. S. N. Upad-

hyay), Narosa Publishing House, New Delhi, pp.134-140.

26. **Khar, A.** (1997). Mechanisms involved in natural killer cell mediated target cell death leading to spontaneous tumor regression. *Journal of Biosciences*, 22: 23-31.

27. **Khar, A.** and **Pardhasaradhi, B.V.V.** (1996). Suppression of tumorogenicity and overexpression of cell adhesion molecules in AK-5 transfected with wild-type p53. *Journal of Biosciences*, 21: 445-454.

28. **Khemani, V.S.** and **Nagaraj, R.** (1996). Competition studies of bovine liver catalase, synthetic peptides and artificial conjugates for luciferase import in a semipermeabilized cell system. *Annals New York Academy of Sciences*, 804: 701-705.

29. **Majumdar, K.C., Shetty, S., Wadhwa, R., Bhaskar, S., Ganesan, M.** and **Singh, L.** (1996). Detection and purification of sequence specific DNA binding protein. *Analytical Biochemistry*, 241: 23-29.

30. **Mayalagu, S., Patturajan, M.** and **Chatterji, D.** (1997). The presence of two tightly bound Zn is essential for the structural and functional activity of yeast RNA polymerase II. *Gene*, 190: 77-85.

31. **Milasincic, D., Dhawan, J.** and **Farmer, S.R.** (1996). Anchorage dependent control of muscle-specific gene expression in C2C12 mouse myoblasts. *In Vitro Cellular and Developmental Biology*, 32: 90-99.

32. **Nagaraj, R.** (1997). Structure-function relationships and engineering of host-defense peptides. *Current Science*, 72: 819-825.

33. **Panda, S.K., Nanda, S.K., Ghosh, A., Sharma, C., Shivaji, S., Kumar, S.G., Kannan, K., Batra, H.V., Tuteja, U., Ganguly, N.K., Chakravarty, A.** and **Chandra, H.S.** (1996). The 1994 plague epidemic of India: molecular diagnosis and characterization of *Yersinia pestis* isolates from Surat and Beed. *Current Science*, 71: 794-799.

34. **Pardhasaradhi, B.V.V.** and **Khar, A.** (1996). Increased apoptosis in AK-5 tumor cells after transfection with wild-type p53 gene. *Indian Journal of Experimental Biology*, 34: 945-948.

35. **Parnaik, V.K.** (1996). Nucleocytoplasmic transport of proteins and control of cellular function. *Indian Journal of Biochemistry and Biophysics*, 33: 164-167.

36. **Pazin,. M., Bhargava, P., Geiduschek, E.P.** and **Kadonaga, J.T.** (1997). Nucleosome mobility and the maintenance of nucleosome positioning. *Science*, 276: 809-812.

37. **Pichare, M.M.** and **Kachole, M.** (1996). Protease inhibition of pigeon pea (*Cajanus cajan)* and its wild relatives. *Physiologia Plantarum*, 98: 845-851.

38. **Rajagopal, L., Yashitola, J., Dharmapuri, S., Karunakaran, M., Rajeshwari, R., Reddy, A.P.K.** and **Sonti, R.V.** (1996). Molecular genetic studies of the bacterial blight pathogen of rice in India. In: *Proceedings of the Third International Rice Genetics Symposium*, in Rice Genetics III. pp.939-944.

39. **Rajaraman, K., Raman, B.** and **Rao, Mohan Ch.** (1996). Molten globule state of carbonic anhydrase binds to chaperone-like α-crystallin. *Journal of Biological Chemistry*, 271: 27595-27600.

40. **Rajkumari, K., Kusano, S., Ishihama, A., Mizuno, T.** and **Gowrishankar, J.** (1996). Effects of H-NS and potassium glutamate on σ^S- and σ^{70}-directed transcription *in vitro* from osmotically regulated P1 and P2 promoters of *ProU* in *Escherichia coli*. *Journal of Bacteriology*, 178: 4176-4181.

41. **Raman, B., Ramakrishna, T.** and **Rao, Mohan Ch.** (1996). Refolding of denatured-reduced lysozyme at high concentration. *Journal of Biological Chemistry*, 271: 17067-17072.

42. **Ranganathan, D., Haridas, V., Madhusudanan, K.P., Roy, R., John, G.B., Sukhaswami, M.B.** and **Nagaraj, R.** (1996). Design, synthesis and ion-transport properties of a novel family of cyclic, Adamantane-containing cystine peptides. *Angewandte Chemie* (International Edition in English), 35: 1105-1107.

43. **Ranganathan, S., Kundu, D., Tamilarasu, N., Dhople, V.M., Jagannadham, M.V.** and **Nagaraj, R.** (1996). The gramicidin pore: selective tryptophan replacement with aspartic acid. *Tetrahedron Letters*, 37: 5199-5202.

44. **Ranganathan, S., Jayaraman, N.** and **Chatterji, D.** (1997). DNA recognition by Zn [Cysteinyl-His-OMe]2 : a minimal zinc finger template docking unit. *Biopolymers*, 41: 407-418.

45. **Rao, K.S., Babu, R.K.K.** and **Gupta, P.D.** (1996). Keratins and skin disorders. *Cell Biology International*, 20: 220-223.

46. **Rathika, V., Thennarasu, S., Naik, N.R., Ajaykumar, Advani, S.H.** and **Bhisey, A.N.** (1996). Granulocytes from chronic myeloid leukemia (CML) patients show differential response to different chemoattractants. *American Journal of Hematology*, 52: 155-164.

47. **Rawat, S.S., Mukherjee, S.** and **Chattopadhyay, A.** (1997). Micellar organization and dynamics: a wavelength-selective fluorescence approach. *Journal of Physical Chemistry, B*: 101: 1922-1929.

48. **Reddy, B.V.B.** (1996). Structural distribution of dipeptides that are identified to be determinants of intracellular protein stability. *Journal of Biomolecular Structure and Dynamics*, 14: 201-210.

49. **Reddy, B.V.B.** and **Datta, S.** (1997). Analysis of structural environment of amino acids that alter *in vitro* protein stability (a short report). *Journal of Biomolecular Structure and Dynamics*, 14:772.

50. **Reddy, B.V.B., Gopal, V.** and **Chatterji, D.** (1997). Recognition of promoter DNA by subdomain 4.2 of *E.coli* σ^{70}: a knowledge based model of –35 hexamer interaction with 4.2 helix-turn-helix motif. *Journal of Biomolecular Structure and Dynamics*, 14: 407-419.

51. **Roy, S., Shashidhara, L.S.** and **Raghavan, K.V.** (1997). Muscles in the *Drosophila* second thoracic segment are patterned independently of autonomous homeotic gene function. *Current Biology*, 7: 222-227.

52. **Saroja, G.N.** and **Gowrishankar, J.** (1996). Roles of SpoT and FNR in NH_4^+-assimilation and osmoregulation in GOGAT (glutamate synthase)-deficient

mutants of *Escherichia coli*. *Journal of Bacteriology*, 178: 4105-4114.

53. **Sharma, S.K., Ram, S.M., Ilavazhagan, G., Devendra, K., Shivaji, S.** and **Selvamurthy, W.** (1996). Mechanism of action of NIM-76: A novel vaginal contraceptive from Neem oil. *Contraception*, 54: 373-378.

54. **Sharma, Y., Chandani, S., Sukhaswami, S.B., Uma, L., Balasubramanian, D. and Fairwell, T.** (1997). Modified helix-loop-helix motifs of calmodulin. The influence of the exchange of helical regions of calcium-binding affinity. *European Journal of Biochemistry*, 243:42-48.

55. **Singh, S.** and **Gupta, P.D.** (1996). Mechanism of action of estradiol: nongenomic events. A chapter in the Book :*Cellular and Molecular Signalling Reproduction*, (ed. J Sengupta and D Ghosh), New Age International Publishers, pp.69-84.

56. **Sinha, S.** and **Das, P.K.** (1997). Dynamics of simple one-dimensional maps under perturbation. *Pramana - Journal of Physics*, 48:87-98.

57. **Sitaram, N., Subbalakshmi, C., Krishnakumari, V.** and **Nagaraj, R.** (1997), Identification of the region that plays an important role in determining antibacterial activity of bovine seminalplasmin. *FEBS Letters*, 400: 289-292.

58. **Srinivas, U.K.** and **Swamynathan, S.K.** (1996). Role of heat shock transcription factors in stress response and during development. *Journal of Biosciences*, 21: 103-121.

59. **Srinivas, V., Rodley, G.A., Ravikumar, K., Robinson, T.W., Turnbull, M.M.** and **Balasubramanian, D.** (1997). Molecular organization in hydrotrope assemblies. *Langmuir*, 13:3235-3239.

60. **Subbalakshmi, C., Krishnakumari, V., Sitaram, N.** and **Nagaraj, R.** (1996), Requirements for antibacterial and hemolytic activities in the bovine neutrophil derived 13-residue peptide indolicidin. *FEBS Letters*, 395: 48-52.

61. **Swamynathan, S.K., Revathi, C.J.** and **Srinivas, U.K.** (1996). Identification and characterization of promoter elements responsible for the induction of albumin gene by heat shock in early embryonic rat liver. *DNA and Cell Biology*, 15: 897-905.

62. **Thanaraj, T.A.** and **Argos, P.** (1996). Ribosome mediated translational pause and protein domain organisation. *Protein Science*, 5: 1594-1612.

63. **Thanaraj, T.A.** and **Argos, P.** (1996). Protein secondary structural types are differentially coded on messenger RNA. *Protein Science*, 5: 1973-1983.

64. **Thennarasu, S.** and **Nagaraj, R.** (1996). Specific antimicrobial and hemolytic activities of 18-residue peptides derived from the amino terminal region of the toxin pardaxin. *Protein Engineering*, 9: 1219-1224.

65. **Thennarasu, S.** and **Nagaraj, R.** (1997). Solution conformation of peptides representing the sequences of the toxin pardaxin and analogs in trifluoroethanol-water mixtures: an analysis of circular dichroism spectra. *Biopolymers*, 41: 635-645.

66. **Uma, L., Sharma, Y., Hariharan, J.** and **Balasubramanian, D.** (1996). Effect of UVB radiation on corneal aldehyde dehydrogenase. *Current Eye Research*, 15: 685-690.

66. **Uma, L., Sharma, Y.** and **Balasubramanian, D.** (1996). Conformational study of corneal dermatan sulfate proteoglycan using fluorescence spectroscopy. *International Journal of Biological Macromolecules*, 19:75-80.

68. **Uma, L., Sharma, Y.** and **Balasubramanian, D.** (1996). Conformation, stability and interactions of corneal keratan sulfate proteoglycan. *Biochimica et Biophysica Acta*, 1294: 8-14.

69. **Uma, L., Sharma, Y., Hariharan, J.** and **Balasubramanian, D.** (1996). Corneal aldehyde dehydrogenase displays antioxidant properties. *Experimental Eye Research*, 63: 117-120.

70. **Vijayalakshmi, V.** and **Gupta, P.D.** (1996). Association of transglutaminase-like antigen with cytoskeletal proteins. *Current Science*, 71: 665-666.

71. **Waheed, A.A.** and **Gupta, P.D.** (1996). Application of an eosin B dye method for estimating a wide range of proteins. *Journal of Biochemical and Biophysical Methods*, 33: 187-196.

72. **Yashitola, J., Krishnaveni, D., Reddy, A.P.K.** and **Sonti, R.V.** (1997). Genetic diversity within the population of *Xanthomonas oryzae* pv.*oryzae* in India. *Phytopathology*, 87: 760-765.

Papers in press

1. **Bhojwani, J., Shashidhara, L.S.** and **Sinha, P.** : Requirement for *teashirt* Function during cell fate specification in developing head structures in *Drosophila*. *Development of Genes and Evolution.*

2. **Bikshapathy, E.** and **Nagaraj, R.** : Manual solid-phase synthesis of peptides with high loading capacity requiring small volume of solvents. *Proceedings of Indian Academy of Sciences (Chemical Sciences).*

3. **Cashikar, A.G., Kumaresan, R.** and **Rao, N.M.** : Biochemical characterization and subcellular localization of the red kidney bean purple acid phosphatase. *Plant Physiology.*

4. **Chattopadhyay, A, Mukherjee, S., Rukmini, R., Rawat, S.S.** and **Sudha, S.** : Ionization, partitioning, and dynamics of tryptophan octyl ester: implications for membrane-bound tryptophan residues. *Biophysical Journal.*

5. **De, P.K.** : Aberrant lacrimal gland development in an anophthalmic mutant strain of rat. Chapter in a book ""*Lacrimal Gland, Tear Film and Dry Eye Syndromes 2*", Plenum Press.

6. **De, P.K.** and **Ranganathan, V.** : Hormonal influences on Syrian hamster lacrimal glands: marked repression of a major 20 kDa secretory protein by estrogens, androgens and thyroid hormones. Chapter in a book "*Lacrimal Gland, Tear Film and Dry Eye Syndromes 2*", Plenum Press.

7. **Devi, U.K., Ahmad, B.M.** and **Shivaji, S.** : A maturation related differential phosphorylation of the plasma membrane proteins of the epididymal spermatozoa of hamster by endogenous protein kinases. *Molecular Reproduction Development.*

8. **Jayaprakash, D., Kumar, K.S., Shivaji, S.** and **Seshagiri, P.B.** : Pentoxifyline

induces hyperactivation and acrosome reaction in spermatozoa of golden hamsters: changes in motility kinematics. *Human Reproduction.*

9. **Khar, A., Pardhasaradhi, B.V.V., Varalakshmi, Ch.** and **Ali, A.M.** : Natural killer cell as the effector which mediates *in vivo* apoptosis in AK-5 tumor cells. *Cellular Immunology.*

10. **Khar, A., Pardhasaradhi, B.V.V., Varalakshmi, Ch., Ali, A.M.** and **Leelakumari, A.**: Participation of ced-3/ICE and YAMA proteinases in the execution of apoptosis in AK-5 tumor cells leading to spontaneous tumor regression. *Cellular Immunology.*

11. **Khar, A., Muralikrishna, K.** and **Varalakshmi, Ch.** : High intratumoral level of cytokines mediates efficient regression of a rat histiocytoma. *Clinical Experimental Immunology.*

12. **Krishnakumari, V.** and **Nagaraj, R.** : Antimicrobial and hemolytic activities of crabolin, a 13-residue peptide from the venom of European hornet, *Vespa crabro* and its analogs. *Journal of Peptide Research*

13. **Los, A.D., Ray, M.K.** and **Murata, N.** : Differences in the control of the temperature-dependent expression of four genes for desaturases in *Synechocystis* sp PCC 6803. *Molecular Microbiology.*

14. **Majumdar, K.C., Ravinder, K.** and **Nasaruddin, K.**: DNA fingerprinting in Indian major carps and tilapia by Bkm 2(8) and M13 probes. *Aquaculture Research.*

15. **Majumdar, K.C., Ravinder, K.** and **Nasaruddin, K.**: Pink body colour in Tilapia shows single gene inheritance *Aquaculture Research.*

16. **Mukherjee, K.** and **Chatterji, D.** : Studies on the 'ω'-subunit of *E.coli* RNA polymerase: Its role in recovery of denatured enzyme activity. *European Journal of Biochemistry.*

17. **Muralikrishna, K., Varalakshmi, Ch.** and **Khar, A.** : Differential modulation of LAK and ADCC functions of natural killer cells from AK-5 tumor bearing rats by IL-2, IL-12 and IFN-γ. *Cytokines, Cellular Molecular Therapy.*

18. **Nagesh, N.** and **Chatterji, D.** : A useful method for the synthesis of 8 azidoguanosine tri- and tetraphosphate: important substrates for many enzymatic reactions. *Journal of Biochemical and Biophysical Methods.*

19. **Narayanan, K., Chandani, S., Ramakrishna, T.** and **Rao, Ch.M.** : Depth profiling of mammalian cells by photoacoustic spectroscopy: localization of ligands. *Biophysical Journal.*

20. **Nagaraju, J.G.** and **Singh, L.S.** : Assessment of genetic diversity by DNA profiling and its significance in silkworm, *Bombyx mori. Electrophoresis.*

21. **Pahari, S.** and **Chatterji, D.** : Bacteriophage T4 AsiA protein binds *E. coli* σ^{70}-subunit around its -35 promoter binding domain *FEBS Letters.*

22. **Pardhasaradhi, B.V.V., Srinivas, U.K.** and **Khar, A.** : Clones with antiapoptotic genes do not undergo acidification upon induction of apoptosis. *FEBS Letters.*

23. **Peedicayil, J., Deendayal, M., Sadasivan, G.** and **Shivaji, S.** : Assessment of hyperactivation, acrosome reaction and motility characteristics of spermatozoa from semen of men of proven fertility and unexplained infertility. *Andrologia.*

24. **Rachel, A.J.** : Genome mapping. *Indian Journal of Endocrinology and Metabolism.*

25. **Rajeshwari, R., Yashitola, J., Reddy, A.P.K.** and **Sonti, R.V.** : Stationary phase variation affecting virulence in *Xanthomonas oryzae* pv. *Oryzae. Canadian Journal of Microbiology.*

26. **Raman, B.** and **Rao, Ch.M.** : Chaperone-like activity and temperature induced structural changes of alpha-crystallin. *Journal of Biological Chemistry.*

27. **Rao, K.L., Varalakshmi, Ch., Ali, A.M.** and **Khar, A.** : Administration of anti-IL-12 antibody *in vivo* inhibits rejection of a rat histiocytoma and suppresses cytokine response in tumor bearing host. *Immunology.*

28. **Ravinder, K., Nasaruddin, K., Majumdar, K.C.** and **Shivaji, S.** : Computerised analysis of motility, motility patterns and motility parameters of spermatozoa from the common carp following short term storage of carp semen. *Journal of Fish Biology.*

29. **Reddy, B.V.B., Ramesh, P.** and **Tiwari, S.** : MEICPS: A program to suggest substitution mutations to engineer intracellular protein stability. *Computer Applications in Biosciences (CABIOS).*

30. **Reddy, M.** and **Gowrishankar, J.** : Identification and characterization of *ssb* and *uup* mutants with increased frequency of precise excision of transposon Tn/0 derivatives: nucleotide seqyence of *uup* in *Escherichia coli. Journal of Bacteriology.*

31. **Shankaranarayanan, P., Banerjee, M., Kecker, R.K., Aggarwal, R.K.** and **Singh, L.S.** : Genetic variation in Asiatic lions and Indian tigers. *Electrophoresis.*

Ph. D. Degree Awarded

Ms. L. Uma. Proteins of the corneal stroma: a spectroscopic study. Jawaharlal Nehru University, April 1996
Guide: Prof D Balasubramanian

Ms. M. Vijaya Gopal. Interaction of *E.coli* Sigma-70 with promoter DNA. Jawaharlal Nehru University, May 1996
Guide: Dr D Chatterji

Mr. Anil G Cashikar. Structural and biochemical characterization of phosphatases in denaturants. Jawaharlal Nehru University, February 1997
Guide: Dr N Madhusudhana Rao

Mr. S. Nambirajan Multiple molecular forms of a protein tyrosine phosphatase. Jawaharlal Nehru University, March 1997
Guide: Dr Ghanshyam Swarup

Ms. Vinisha S Khemani. Intracellular sorting of proteins: protein import to peroxisomes. Jawaharlal Nehru University, March 1997
Guide: Dr R Nagaraj

Mr. A. V. Rao. Physiological and biochemical studies on the calcium nutrition of *Brassica oleracia* L.Var. *capitata.* Osmania University, June 1996
Guide: Dr Janardhan Reddy ❑

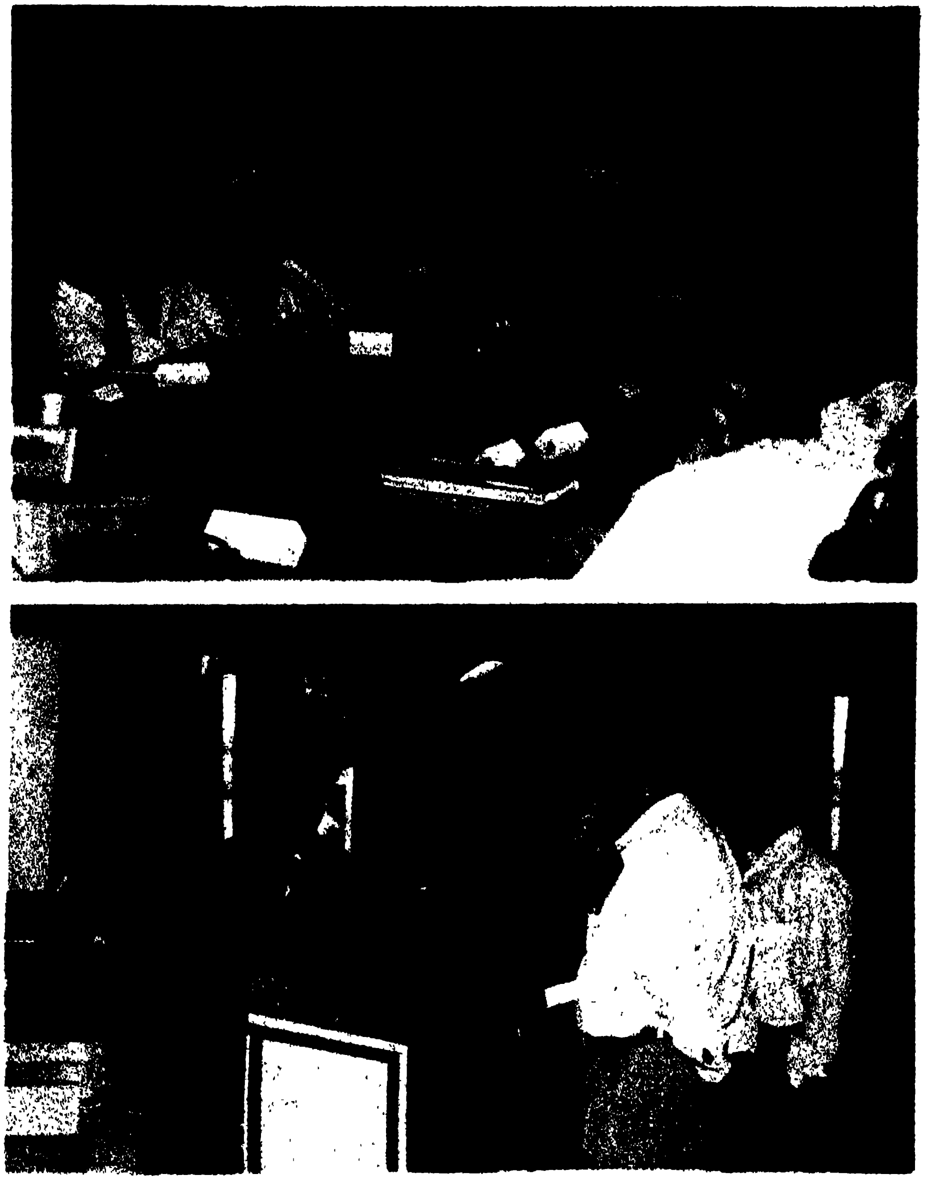
Industry-Institute Get-together cum Technology Demonstration on Medical Instruments developed by CSIO

THE Central Scientific Instruments Organisation (CSIO), Chandigarh, organized an Industry-Institute Get-together cum Technology Demonstration Programme on 31 July 1997, to help promote transfer and commercialization of its know-how on Medical Instruments. Fourteen representatives from the following seven industries attended: M/s Electronics India, Panchkula; M/s Pamba Electronic Systems Pvt. Ltd, Ernaculam; M/s Somit Electronics & Medicare Systems Pvt. Ltd, SAS Nagar; M/s AMI Medical Systems, Vadodara; M/s Bergen Health Care (P) Ltd, Gurgaon; M/s Recorders & Medicare Systems, Chandigarh; and M/s Environmental & Scientific Instruments Co, Panchkula. In addition, senior officials from DST and DoE who had sponsored the various developments, and a number of clinicians from PGI, Chandigarh, attended the event.

The Interaction Meet was chaired by Prof. S.K. Guha, Centre for Biomedical Engineering, IIT, New Delhi, and Chairman of the Steering Committees on Medical Instruments of DST and DoE.

Welcoming the participants, Prof. S. Mohan, Director, CSIO, informed that the institute had organized one such meet in the recent past and had plans to hold such meets more frequently in future, in view of their potential in bringing industry closer to the institute. Describing this particular get-together as a unique event in which all major components for launching medical instruments, viz. the development team, the clinicians involved, the industry and the representatives from the government, were present, Prof. Mohan gave an outline of the medical instrumentation activity being pursued at CSIO, including the repair and maintenance services and human resource development.

In his opening remarks, Prof. Guha lauded the R&D activities of CSIO in the field of medical instrumentation and mentioned that this could be made possible owing to the excellent team work undertaken in collaboration with PGI. He said that final shape to any development is given by the industry only. Being closer to the user, it can give a better



Prof. S Mohan, Director, CSIO, welcoming the participants of 'Industry-Institute Get-together cum Technology Demonstration on Medical Instruments developed by CSIO'. The second photograph shows a Scientist giving the demonstration of RF Hyperthermia System for localized cancers feedback. Without the help of industry, the development work would remain stacked on lab shelves, Prof. Guha averred.

Speaking on the occasion, Shri B.S. Bedi, Director, Department of Electronics (DoE), New Delhi, complimented the CSIO Director for having a very constructive and pragmatic approach. According to him, since the medical instruments industry in the country is in nascent stage, collaborative efforts between R&D organizations and industry are a dire necessity. He expressed the hope that this get-together would meet its objectives and would lead to commercialization of technologies developed by CSIO.

Shri S. Sudershan Rao of Instrument Development Programme, Department of Science & Technology (DST), New Delhi, highlighted the problems of after-sales service in the country.

Participating in the discussions, one of the clinicians from PGI, Prof. Sharma appreciated the development of 4 MeV Linac by CSIO in collaboration with SAMEER and PGI, with funding from DoE. He opined that there is immense potential for its marketing. After-sales service for the maintenance of the equipment also need to be strengthened, he emphasized.

Dr (Smt.) S. Kataria supported the view that desired results cannot be derived from the research institutes alone and called upon the industry to come forward and collaborate with the research institutions.

Giving an overview of medical instrumentation activities of CSIO, Shri S.R. Taneja, Convener of the get-together, acknowledged the help of the PGI and clinicians present on the occasion, who had been motivating the development teams besides providing guidance and other vital inputs, particularly during clinical trials. Shri Taneja also pointed out that besides commercializing the know-how developed by CSIO, there is a need for the industry to collaborate with CSIO in all its future programmes to make the former competitive.

The representatives from industry raised several questions to the clinicians, particularly relating to the success of the programmes undertaken by CSIO, as judged from the clinical trials, the requirements of these instruments in the country, their conformity to BIS specifications, safety aspects, etc. The clinicians dispelled all doubts of the industry by explaining to them how they had conducted the clinical trials and the results that had finally emerged. One of the clinicians mentioned that of the several developments presented, he had evaluated four instruments developed for small babies and he was satisfied to the extent that if he had an industry, he would have taken production of all the four.

In the afternoon, a committee consisting of Prof. S.K. Guha, Prof. S. Mohan, Shri S. Sudershan Rao, and Shri B.S. Bedi (present for assigning the know-how of Pulse Oximeter) met the representatives from industry on one-to-one basis to hold discussions on issues pertaining to transfer of know-how.

During the discussions, assignment of the following know-hows was agreed upon:

- Servo Controlled Baby Care Incubator (M/s Bergen Electronics Ltd, Gurgaon)
- Drug Infusion Pump & Controller (M/s Bergen Electronics Ltd, M/s Pamba electronics (P) Ltd, and M/s Environmental and Scientific Instruments Co., Panchkula)
- Pulse Oximeter (M/s Pamba Electronics (P) Ltd)
- Low-cost Portable Ultra-sound Scanner (M/s AMI Medical Systems, Vadodara).

M/s Somit Electronics & Medicare Systems Pvt. Ltd, SAS Nagar, expressed their desire for taking up the know-how of the following instruments: Drug Infusion Pump & Controller, Pulse Oximeter, Resuscitation Bag for neonates, Ophthalmoscope & Otoscope Diagnostic Set, and Drivers Reflexes Response Testing System.

Thus, going by the response, the meeting was a great success. CII could not participate, although it expressed a desire for a similar meeting exclusively for its member companies in the Medical Equipment Division soon. ❑

Honours & Awards

Prof. A. K. Gupta

PROF. A. K. Gupta, Director, Central Road Research Institute (CRRI), New Delhi, has been elected to the Board of Directors of International Road Federation (IRF) in the 'Class of 2000' for a term of three years.

IRF is a body of international acclaim in the field of road research. CRRI has professional links with IR.

Dr Anand Kumar

DR Anand Kumar, C-MMACS, Bangalore, was invited to be a keynote speaker at the forthcoming Seventh International Symposium on CFD to be held at Beijing, China, in September 1997. He spoke on Flow consistent grid in CFD. ❑

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit
Annual Subscription : Rs. 60
[illegible]ors : Dr B.C. Kashyap and Dr C.S. Gupta Editorial Assistant : Neelima Handoo Production : Kaushal Kishore Single Copy : Rs. 3.00
Phone : 5786301 Gram : PUBLIFORM Telex : 031-77271 E-mail: niscom@simetd.ernet.in. Fax : 5787062

ISSN 0409-7467

CSIR NEWS

The Institute of Himalayan Bioresource Technology, Palampur's R&D programmes pertain to : Hill Area Tea Science, Natural Plant Products, Floriculture, Biotechnology, and Conservation of Biodiversity (p. 309). Shown here are some Orchid taxa in flower in polytunnel *(Cymbidium giganteum, Dactylorhiza hatagirea, Dendrobium nobile and Rhynchostylis retusa)*; Demonstration of mechanical harvesting of tea in a farmer's field *(top right)* and *In-situ* measurement of leaf gas exchange *(above right)*

CSIR wins battle on US Patent on Turmeric Powder

THE Council of Scientific & Industrial Research (CSIR) had challenged on 28 October 1996, the US Patent No. 5401504, which had been granted for the use of turmeric powder as a wound healing agent on 28 March 1995. Specifically, it asked for the re-examination and complete cancellation of all the six claims present in the patent. After protracted techno-legal arguments, the US Patent and Trade Mark Office (US PTO) has unequivocally rejected all the six claims of this patent on 13 August 1997, ruling out finally that the invention is not patentable.

This is a significant development of far reaching consequences for the protection of the traditional Indian knowledgebase in the public domain, which has been an emotional issue for not only the people of India, but also for the other Third World countries.

Brief History of the Case

The University of Mississippi Medical Centre, Mississippi, USA, had filed an application for patent at US PTO for the use of turmeric powder as a wound healing agent on 28 December 1993. The patent was granted on 28 March 1995. In June 1996, CSIR took up the initiative with the concurrence of Ministry of Industry (Department of Industrial Development) to seek re-examination of this patent on the basis that the invention covered in the said patent does not satisfy the important criteria of patentability, viz. the novelty. This was because the use of turmeric powder as a wound healing agent was very well known in India for centuries.

CSIR, after a careful and detailed study of the voluminous literature available on the subject in various languages, selected the relevant documents (*see box*), which disclosed clearly and precisely the use of turmeric powder as a wound healing agent. The request for re-examination was filed at the US PTO through M/s Merchant & Gould, a leading Patent Attorney in USA on 28 October 1996.

The US PTO admitted the request of CSIR as there was a *primafacie* case for initiating the re-examination proceedings. The US PTO, after critically examining all the evidence provided by CSIR, issued an initial official action on 28 February 1996 rejecting all the claims. The assignee, University of Mississippi Medical Centre, appreciating the strength of the evidence submitted by CSIR, was not interested in contesting the re-examination. However, the inventors decided to contest the proceedings in their personal capacity and submitted their rejoinder to the official action of the US PTO on 28 May 1997.

Finally, after considering all the arguments presented by the present patent owner and on re-evaluation, the US Patent Office did not accept any of the arguments presented by the patent owner and maintained the rejection of all the six claims of the patent by their action dated 13 August 1997, thus making the rejection a final rejection.

The six claims present in the patent were as follows:

(1) A method of promoting healing of a wound in a patient, which consists essentially of administering a wound healing agent consisting of an effective amount of turmeric powder to said patient;

(2) The method according to claim 1, wherein said turmeric is orally administered to said patient;

(3) The method according to claim 1, wherein said turmeric is topically administered to said patient;

(4) The method according to claim 1, wherein said turmeric is both orally and topically administered to said patient;

(5) The method according to claim 1, wherein said wound is a surgical wound; and

(6) The method according to claim 1, wherein said wound is a body ulcer.

All the six claims have been rejected by the US Patent Office under 35 U.S.C. 102(b) and 35 U.S.C. 103(a) of the US Patent Statue.

Significant Consequences

- This appears to be the first case where the use of traditional knowledgebase of a Third World country, patented through a US Patent has been successfully challenged with the US PTO leading to complete cancellation. It may be recalled that earlier efforts made by several interested groups to challenge the *neem* patent were not even entertained for admission by the US Patent Office.
- This success story strongly sends signals that if patent cases are fought on well argued and well supported techno-legal grounds, then there is nothing to fear about protecting our traditional knowledgebase.
- This case also demonstrates that CSIR and other Indian institu-

tions are now acquiring capabilities to fight the complex techno-legal issues of IPR, both defensively and aggressively, to meet the challenges under the WTO regime.

- This case also emphasizes the importance of appropriate documentation and public availability of records of traditional knowledgebase in a systematic manner, which can be provided as evidence of prior knowledge which is an important criterion for the grant of a patent. It was only through painstaking search and careful selection of the documents, which had a direct bearing on all the claims in the patent, that CSIR could produce evidence acceptable to the US Patent Office, so that the case for re-examination was immediately admitted.

- This success is also likely to enhance the confidence of people of India and help in the process of removing unfounded fears about India's helplessness on preventing bio-piracy and appropriation of inventions based on traditional Indian knowledgebase. ☐

THE DOCUMENTS

I. Gujral et al., 'The Effect of Indigenous Remedies on Wounds', *Journal of Indian Medical Association*, Vol. XXII, No. 7, pp 273-276 (1953)

II. Frawley, *Ayurvedic Healing*, pp 221-223 (1989)

III. *The Wealth of India*, pp 401-405 (1950)

IV. *Indian Materia Medica*, pp 414-418 (1976)

V. *Economic and Medicinal Plant Research*, Vol.4, pp 149-151 (1990)

VI. Sivananda, *Home Remedies*, pp 233-235 (1958)

VII. *The Ayurvedic Pharmacopoeia of India*, pp 45-46 (1986)

VIII. *Selected Medicinal Plants of India*, p 56 (1992)

IX. *Indian Medicinal Plants Used in Ayurvedic Preparations*, pp 121-124 (1980)

X. Srimal, 'Haldi Can Heal', *Science Today*, pp 26-27 (1986)

XI. Rastogi et al., *A Compendium of Indian Medicinal Plants*, Vol. 4, 1985-1989 (1993)

XII. Ray et al., *Sushruta Samhita*, p 62 (1980)

XIII. Amman et al., 'Pharmacology of *Curcuma longa*, *Planta Med.*, Vol. 57, pp 1-6 (1991)

XIV. Amman et al., 'Curcumin : A Potent Inhibitor of Leukotriene B4 Formation', (1992)

XV. Srinivas et al., 'Turmerin: A Water Soluble Antioxidant Peptide from Turmeric', *Archives of Biochemistry and Biophysics*, Vol. 292, No.2, pp 617-623 (February 1, 1992)

XVI. Jain, *Dictionary of Indian Folk Medicine and Ethnobotany*, pp 65-66 (1991)

XVII. Asolkar et al., *Second Supplement to Glossary of Indian Medicinal Plants with Active Principles Part-I (A-K) (1965-1981)*, pp 246-247 (1992)

XVIII. Shalini et al., 'Fuel Smoke Condensate Induced DNA Damage in Human Lymphocytes and protection by Turmeric (*Curcuma longa*)', *Molecular and Cellular Biochemistry*, Vol. 95, pp 21-30 (1990)

XIX. Srinivan et al., 'DNA Damage by Smoke: Protection by Turmeric and Other Inhibitors of ROS', *Free Radical Biology and Medicine*, Vol. 11, pp 277-283 (1991)

XX. Sharma, *Dravyaguna-Vijana, Vol.II (Vegetable Drugs)*, pp 162-164 (1984)

XXI. *Chaukhambha Orientalia*, Section 332 (1979)

XXII. *Rajanighantu of Pandit Narahari*, pp 174-175 (1939)

XXIII. *Bhavaprakasha*, p 115 (1969)

XXIV. Sharma, *Ayurveda Ka Vaijnanika Itihasa*, p 187 (1975)

XXV. Chauhan, *Kya Khain Aur Kyon*, p 157 (1979)

XXVI. Sattar, *Bustanul Mufredat*, p 252 (1867)

XVII. Satry, *Prayogatmak Abhinav Dravyaguna Vigyanam*, pp 354-356 (1991)

XXVIII. Kabiruddin, *Makhzanul Mufredat*, Vol. II, pp 207-208 (1955)

XXIX. Khan, *Khazanatul Adviya* Vol. 3, pp 909-910 (1920)

XXX. Dhawan, 'Turmeric—A Gold Mine', *Indian Spices*, Vol.30 No. 283, pp 19-20 (1993)

XXXI. Reddy et al., 'Studies on Anti-inflammatory Activity of Spice Principles and Dietary n-3 Polyunsaturated Fatty Acids on Carrageenan-induced Inflammation in Rats', *Am. Nutrition Metals* (1992)

XXXII. Dey, *Indian Medicinal Plants*, p 157 (1988) ☐

Environment-friendly Cokeless Cupola

THE normal cupolas in India and in most of the other parts of the world are operating with coke as fuel, and the emissions from such cupolas have been found to contain Suspended Particulate Materials (SPM) ranging from 400 to 3,000 mg/Nm^3 with sulphur dioxide content being 200 to 700 mg/Nm^3, which is excessively high. The recommended acceptable figures by the Central Pollution Control Board (CPCB), New Delhi, are 150 mg/Nm^3 for SPM and 300 mg/Nm^3 for sulphur dioxide.

To overcome the pollution problem, Cokeless cupola was introduced in the United Kingdom in 1971 and it has since been used in twenty other countries all over the world. The cokeless cupola is operated using either liquid fuel or almost-sulphur free natural gas. The use of liquid/gaseous fuel promises extremely low level of SPM as well as sulphur dioxide, and does not require any pollution control device along the flue gas ducting and can very well be installed within the municipal limits.

With continuous efforts of the government towards introduction of strict pollution control strategies, most of the cupola-based industries are now looking for cokeless operation. A cokeless cupola is expected to have the following advantages: (1) Very low pollution, no emission control equipment; (2) Overall reduction in the melting cost; (3) Lower capital and maintenance cost; (4) Easy and better process control; Ease of making spherodized grey iron, (5) Excellent quality of iron; and (6) No coke storage or handling/facility.

The National Metallurgical Laboratory (NML), Jamshedpur, based on a thorough study, opted for the design and development of a cokeless cupola of 225 mm. On successful completion of the work, NML approached TIFAC (DST), New Delhi, for getting the latter's sponsorship for a project on converting the existing 500 mm ID cupola, to which TIFAC agreed.

NML carried out development work in the following steps: (1) Fixing the design parameters of a cokeless cupola, (2) Conversion of existing coke-based 500 mm ID cupola to cokeless operation facility using either oil or gas, (3) Design and incorporation of specialized oil and gas burners, (4) Special design of a water cooled grate, (5) Development and testing of refractory balls required to support the metallics in the stack, (6) Design and erection of peripheral facilities such as oil pumping station, oil storage facility, gas station, water circulation system, graphite injection system, etc. and (7) Conducting a large number of trials for providing various components and identifying their performance characteristics.

Some of the parameters established by NML are: (1) Size of the cupola: 500 mm ID x 4 m high, (2) Melting rate: 1000 kg/h. (3) Oil consumption : 60 litres/h. or 30 Nm^3/h. LPG gas, (4) Water consumption: 5 litres/min. to limit the rise in temperature to 20°C, (5) Metal temperature: 1350°C.

Refractory spherical high strength ball for environment-friendly cokeless cupola

NML has developed refractory spherical balls of 100 to 150mm dia with high strength, refractoriness and thermal shock resistance for environment-friendly cokless cupola. The cokeless cupola is very similar to classical coke-fired cupola. The burners are located approximately in the same position as the tuyeres. Above the burner there is a water cooled grate consisting of steel tube which may be coated with refractory for insulation purpose. This water cooled grate supports the specially developed refractory balls above it. These refractory balls act as a heat exchanger and are responsible for superheating the metal. Metallic charge is brought on the spheres from above with small quantity of flow. As there is no coke in the cupola there is no carbon pick-up during melting. Process is therefore environment-friendly and demands continuous injection of suitable recarburizer into the furnace in order to achieve the required carbon content. NML- developed refractory balls are being produced at pilot scale and used in the actual melting operation by putting them on water-cooled grate in place of coke grate. The overall performance of the refractory balls has been found to be quite satisfactory.

Institute of Himalayan Bioresource Technology, Palampur
R&D Highlights: 1995-96

THE major areas of research at the Institute of Himalayan Bioresource Technology (earlier, CSIR Complex) Palampur, pertain to: Hill Area Tea Science; Natural Plant Products; Floriculture; Biotechnology; and Conservation of Biodiversity.

A number of institute's research projects are sponsored by DST, DBT, etc., and some private organizations. During 1995-96 the cash flow from the externally-funded projects was Rs 4.403 million, and the revenue generated from the lab produce amounted to Rs 0.215 million. The total financial outlay for the year was Rs 34.258 million. Presented below is a brief account of some of the major activities during the year:

Hill Area Tea Science

Two biclonal seed stocks from UPASI were added to the existing germplasm bank of 187 accessions. Fifteen prolonged flushers, 44 early flushers, and 71 bushes on the basis of bush size, pruning litter weight and plucking point density, were selected from local populations for further evaluation.

With the objective of developing a compact package for improving productivity and quality of tea, work was continued on various aspects of young and mature tea plants management and tea processing. For bringing up young tea plants into an early economic bearing, application of N:P:K in the ratio of 3:2:4 and ethephon treatment @ 1500 ppm gave promising results. Mechanization of farm operations such as pruning, skiffing, and plucking was also undertaken on a large scale.

Investigations on herbicide rotation in mature tea showed that atrazine 1.25 kg/ha + glyphosate 1.03 kg/ha followed by pendimethalin 1.13 kg/ha + glyphosate 1.03 kg/ha give higher yield (2461 & 2189 kmth, respectively) than glyphosate 1.03 kg/ha + atrazine 1.25 kg/ha (2050 kmth). Higher yield was obtained by a pre-emergence herbicide treatment followed by a post-emergence herbicide treatment. Evaluation of certain pre-emergence herbicides (atrazine, oxyfluorfen, and pendimethalin) in tea nursery raised from seeds of local china hybrid tea and stem cuttings of four clones (UPASI-9, Asha, Phoobsering-312, and Tukdah-78) was in progress.

Ten tea clones and seed-raised plants were screened against pathogen populations collected from various tea growing areas of Kangra Valley under controlled conditions to assess the variability and identify diverse sources of resistance against Blister Blight pathogen. The tea clones showed variation in disease response against pathogen isolates from different locations. Work is in progress on the elucidation of host-parasite relationship in relation to clonal response to the disease.

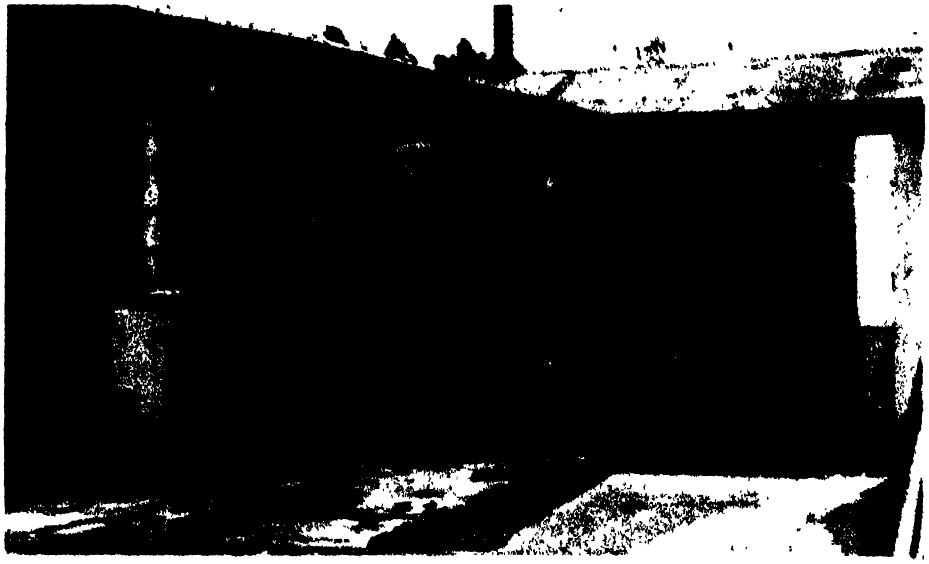
Different plant materials were screened for their ability to form theaflavin-like pigment with combined tea catechins. Using acetone powder made out of different sources, only tea gave theaflavins while other plants gave different type of ethyl acetate extractable products. Washed acetone powder could be successively used for several batch type of reactions.

Tea-based concentrates made for preparing cold beverages were tested for stability. The concentrates could be stored without preservatives at 4°C for over 6 months with no loss of quality. A tea-based fermenter system was studied for exclusive repeated batch production of TF. Germplasm collections and field selections were screened for infusion characteristics and flavour-profiles to identify potential quality material(s). Quality parameters of organically grown tea and conventionally grown tea were compared for green leaf and made-tea.

No residue of pesticide endosulfan and organophosphates was detected in 93 samples of made-tea, collected from factories and markets of Kangra Valley and Dehra Dun area. An experiment on residue levels of dimethoate indicated the need for modification of dimethoate application for containing residue levels within prescribed limit of 0.1 ppm MRL.

Natural Plant Products

Plantation of strain Type-II of *Rosa damascena* was extended to Kullu district. Its flowers on distillation gave 0.03% oil yield on pilot scale and the oil was evaluated qualitatively. Also, rose water of three different grades was prepared and its quality evaluated on the basis of chemical composition and odour value. Also, essential oil of *Tagetes minuta* (2nd harvest) was evaluated; the ocimenone content was found to be significantly higher



Rose oil distillation unit

than that in the oil from the first crop.

Eleven compounds were isolated and characterized from *Taxus wallichiana* and *Tagetes minuta* extracts. Taxol, cephalomanine, rhododendrin, C-22 straight chain carboxylic acid, and two biflavonoids of amentoflavone series were identified from *Taxus wallichiana*. C-27 straight-chain alcohol, stigmasterol, two acetylated thiofurans and two disaccharides were isolated and characterized from *Tagetes minuta* roots.

Jasminum grandiflorum recorded increase in flower yield from 35 q/ha in second year to 40 q/ha in the third year. Recovery of concrete could be increased from 0.3% to 0.4% as a result of modifications made in the extraction process.

Pruning time, height, and number of prunings were evaluated for flowering behaviour of rose bushes. Type-II selection was found to be more sensitive to height and time of pruning in comparison to Type-I selection. It was found that young plantations should be pruned successively at a height of 45 cm with an increase in the height of pruning by 15 cm every year up to the age of 5 years. Pruning should be done during the month of November under normal conditions. Single pruning during optimum time proved to be better.

Existing rose oil distillation unit was modified by integrating a cohobation column to improve the yield and quality of rose oil. Direct fired field scale distillation units with a batch capacity of 50 kg and 400 kg were designed and installed. The 50 kg unit can be more useful for small growers with low capital investments for extraction of rose water, rose oil and its blends. The improved rose distillation unit is being tested for its working and quality of rose oil.

Floriculture

The institute is recognized as the driving force for the development of floriculture industry in Himachal Pradesh. The growers trained at the institute have successfully brought the name of H.P. on the floriculture map of India.

Six cvs. of perpetual flowering carnations were collected during the year, and added to the germplasm collection. Multiplication of these carnations is in progress.

After rigorous screening, twelve gladiolus hybrids were selected for final screening and subsequent release.

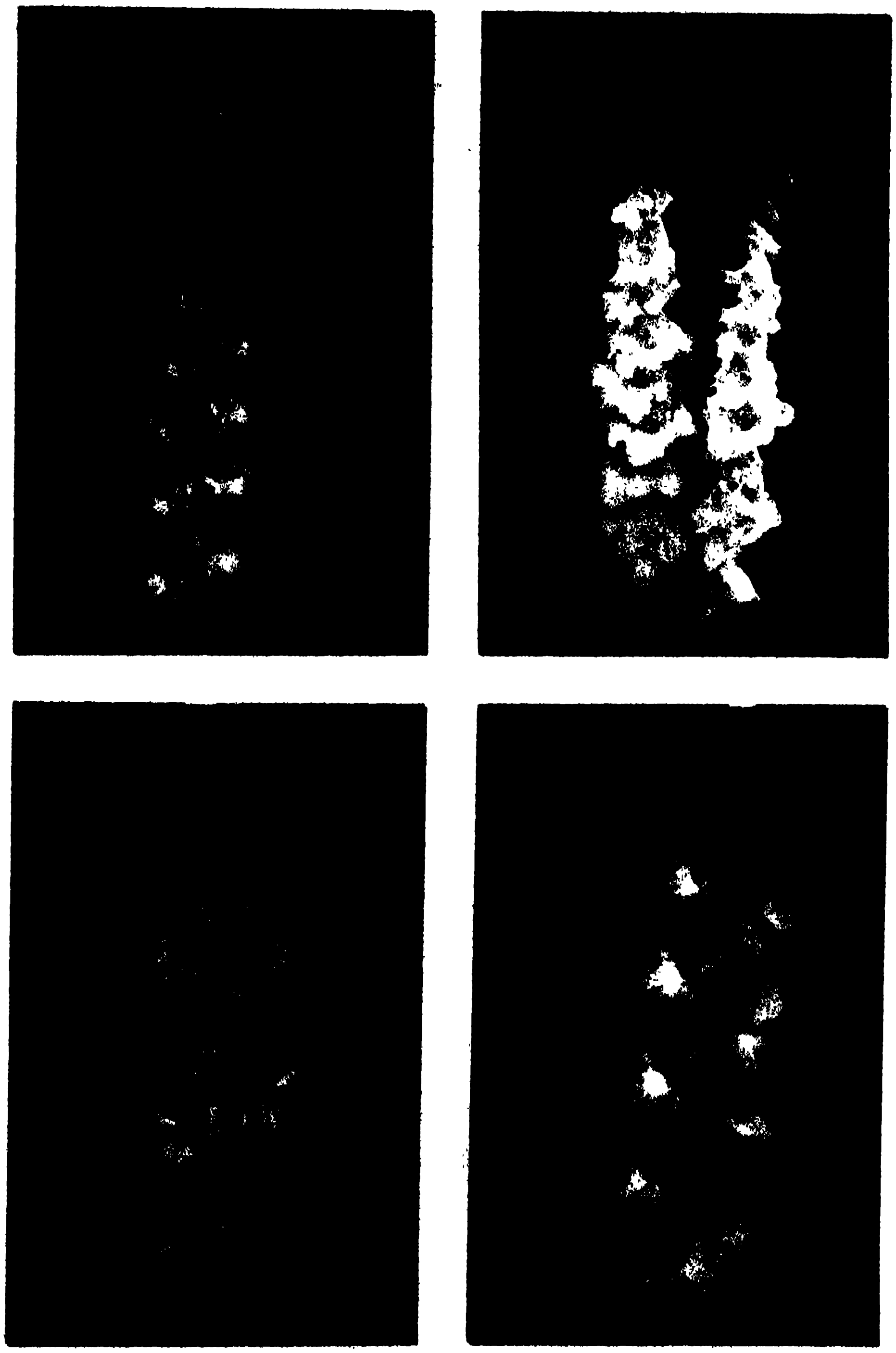
Collection of wild roses is being screened for better root stocks which are winter active and tolerant to stress and diseases. Multiple pruning in roses for increased production of marketable cut roses has been advocated. Production of cut roses per plant/unit area at Palampur could be doubled without affecting the plant vigour. Also, the time for production of cut roses could be extended for 8-9 months against the usual 2-3 months.

Bulbs of eight cultivars of Tulips and three types of liliums were subjected to forcing treatment to enhance flower and bulb production. Bulbs of Asiatic hybrids and *Lilium longiflorum* hybrids could be planted up to March end.

'Bird of Paradise' plants were treated with two plant growth regulators, viz. GA_3 (250 ppm) at monthly interval, followed by kinetin (100 ppm) spray after a fortnight. Another set of the plants was treated with kinetin (100 ppm) every month followed by GA_3 (250 ppm) spray after a fortnight. In both cases, the treated plants showed appreciable increase in plant growth (83.6% and 99.6% respectively), without any abnormalities.

Three plant growth regulators, viz. Benzyladenine (BA), Gibberellic Acid (GA_3) and Ethrel were tried on three cvs. of gladiolus, viz. 'Friendship', 'Priscilla' and 'Video'. Out of the three chemicals, Ethrel showed a better performance in breaking the dormancy.

Seven cvs. of spray chrysanthemums, viz. 'Inga', 'Regol Time', 'Mundiyal', 'Bronze Mundiyal', 'Royal Mundiyal', 'White Stafour' and 'Funshine' were grown under greenhouse conditions. Greenhouse cultivation techniques developed at the institute doubled the flower production and increased size and longevity in spray chrysanthemums.



Gladiolus hybrids raised by the Palampur institute

Virus tested plants of *Lilium sp.* and gladiolus were developed and transferred to the pots after hardening. Prunus Ring Spot Virus (PRSV) was detected in rose, and after callusing, no PRSV titer was shown by ELISA test. Viral diseases were recorded on *Tulipa gesneriana* cv. 'Leen Van Der Mark' and cv. 'Knees Neils', Asiatic lilies, carnation, and gladiolus. Selected virus transmission and host range studies were also conducted.

Biotechnology

Five hundred micropropagated tea shoots after hardening and rooting were replanted in sleeves for further development and field transfer. Upscaling of the protocol at a pilot scale was underway. A few more high yielding and elite clones, viz. Tukdah-78, Phoobsering-312 and UPASI-9 have also been brought in culture. Three biclonal hybrids were multiplied using embryo rescue technique.

To improve upon the existing conventional methods of propagation of tea, experiments were initiated to induce rooting in four leaf and eight leaf cuttings by treating the shoots with various growth regulators and phenolics. About 85-90% success in rooting was achieved with eight-leaf and four-leaf cuttings. This approach, if found suitable for field establishment, will reduce the time in producing plants for field transfer.

Two strains of *Agrobacterium tumefaciens*, LBA4404 and EHA105 were employed in experiments on genetic transformation of somatic embryos and embryogenic calli derived from tea cotyledon explants. GUS positive activity was observed in some transformed embryogenic calli and embryos. Work was in progress to improve the regeneration and transformation system using tea somatic embryos.

The on-going programme on bamboos is being partly funded by the GB Pant Institute of Himalayan Environment and Development, Almora, through a sponsored project entitled 'Mass propagation of *Dendrocalamus hamiltonii* and *D. hookeri* using single node cuttings'. Screening and selection of superior seedling-raised bamboos for both macro- and micro-propagation is in progress in *Dendrocalamus hamiltonii* and *D. hookeri*. Cost-effective methods for micropropagation have also been tried to make tissue culture of bamboos an economically viable proposition.

The studies on micropropagation covered: Raising field plantation of 865 plants of two selected clones of *D. hamiltonii*; Developing macropropagation nursery potential of 2500 plants; Creating capacity for hardening of tissue culture raised plants; Supply of ca. 200 selected elite plants of *D. hamiltonii* for testing in the plains of Punjab and Haryana; Analyzing leaf samples of *D. hookeri* for the suitability of the species as a winter fodder plant.

Culm samples of elites from field selected plants of both *D. hamiltonii* and *D. hookeri* were released for evaluation of their suitability for paper manufacture.

Species of *Dendrobium and Cymbidium* were collected from north eastern Himalayas and kept in pots in polytunnels under foggers. Hand pollination was successfully attempted in *Dendrobium nobile*. Immature seeds from undehisced green pods were inoculated on culture media and protocorm formation was achieved. *In vitro* raised seedlings of *Dactylorhiza hatagirea* and *Rhynchostylis retusa* have been transferred to polytunnels under foggers. Experiments are in progress to assess their survival rate. In *Dendrobium nobile and Coelogyne sp.*, young protocorms at two leaf stage, when transferred to petriplates containing sphagnum moss and soilrite, have shown good growth. Their further growth and development is being monitored.

Successful hardening of tissue culture raised shoots of *Rosa damascena* could be achieved. Alterations in basal medium and use of thidiazuron facilitated better shoot regeneration. This has now made possible the protocol for the micropropagation of *Rosa damascena*.

Physical and biological aspects of nitrogen dynamics in china hybrid tea showed the importance of upper maintenance foliage in maximum mobilization of nitrogen to two and a bud during bud break. Normal and defoliated bush showed considerable improvement in yield of defoliated bushes during normal plucking season as well as at bud break. Poor nitrifying activity in soil favoured the application of ammonium sulphate as a source of nitrogen to avoid 'run-off' in the form of nitrate.

Work has been initiated on oxygen metabolizing enzymes in different tea clones to assess their importance during low temperature conditions. Superoxide dismutase (SOD) from chinary type was purified and a procedure for its assay was standardized. Ascorbate peroxidase (APX) and SOD were monitored in thirteen tea clones during different months, and clones responsiveness in terms of SOD/APX to low temperature was studied.

The work on fingerprinting of tea clones is being jointly undertaken by the Biotechnology and HATS divisions. Initially, 38 clones, representing the diversity in terms of Assam type, China type, Cambod type and some ornamental *Camellia* species were included for RAPD analysis. A rapid inexpensive DNA isolation protocol was standardized. Amongst the primers employed for the amplification of the genomic DNA, four showed heterogeneity. PCR protocol for amplification of the DNA was also standardized.

Studies on seed biology in tea are continuing and experiments have been carried out for the germination of tea seeds. Polyembryony was recorded in the chinary clones. Clone to clone differences were also observed in the germination response. Estimation of starch, sugars, proteins, RNA and phenos has been undertaken in different parts of the seed at each developmental stage.

Biodiversity

Survey of Lahaul and Spiti areas of Himachal Pradesh was conducted during the year. Natural distribution and habitat of important, rare and threatened species, viz. *Aconitum heterophyllum, Dactylorhiza hatagirea, Hippophae rhamnoides, H. tibetana, Picrorhiza kurrooa, Podophyllum hexandrum, Rheum australe, Rosa webbiana,* etc. were studied and propagules were collected for their introduction in the herbal garden of the institute.

The germplasms of *Artemisia* spp., *Valeriana jatamansi* and other target species were also collected.

Studies were undertaken to understand the physiological basis of plant adaptation along an altitude range of 1300-4000 m. Data for photosynthesis, fluorescence characteristics and respiratory dynamics were collected. While there was not much difference in gas exchange rate along the altitudinal range, fv/fm values at higher altitudes were found to be extremely variable. Respiratory dynamics showed a very high alternative respiration capacity in plants at higher altitudes. Analysis of the CO_2 curve made for different plant species is being carried out.

Investigations on the conservation of genetic resources in western Himalayas were continued. Propagation and cultivation of three plant species has been achieved and over 130 species of rare plants are being maintained in the herbal garden of the institute. A database on the phenological and ethnobotanical aspects is being created. More than 500 voucher specimens of ethnobotanically important, rare and threatened plants were added to the institute's repository. The collected species were identified, processed, mounted and incorporated in the herbarium. Listing of some important species containing bio-active compounds and found in different parts of the country has been undertaken. A database pertaining to ethnobotanical information and economic plant resources of western Himalayas is also being built up.

Work on domestification and development of agrotechnology for propagation and husbandry of some target species, viz. *Rumex hastatus* D. Don and *Valeriana jatamansi* Jones is in progress. In case of *R. hastatus*, a temperature of 27-28°C with 90% RH has been found to be suitable for seed germination. Freshly harvested seed exhibited better germination. Crop of *V. jatamansi*, when grown under shade and under canopy cover of certain fast growing tree species, performed better than that in the open field.

During 1995-96, the Department of Biotechnology sponsored a research project entitled 'Biotechnology in Conservation of Economic Plant Diversity in Western Himalayas' and yearmarked Rs 3.243 million over a period of three years, with the objective of development of methodology, infrastructure, and expertise that can efficiently imbibe, utilize and transfer relevant technologies to a biodiversity programme to and from the Indian Western Himalaya. Necessary infrastructure has been created to fulfill these objectives. Initiatives have been taken with regard to DNA fingerprinting of *Valeriana wallichii* and *Artemisia* sp.

To understand the physiological basis of plant adaptation, data for photosynthesis, fluorescence characteristics, and respiratory dynamics have been collected at an altitude of 1300-4000 m.

Technology Transfer and Marketing

Advisory visits were paid to 30 tea estates, covering an area of 600 ha. Technical back-up was provided, at an advisory consultancy fee of Rs 0.2 million, to Uttarakhand Tea Development Agency of Hill Development Department, Government of Uttar Pradesh, to raise more than 2.2 million clonal and biclonal seedstock plants and plant young tea on 100 acres. In addition to the ten existing Technology Demonstration Plots, Tea Boards of India sanctioned Rs 0.6 million to establish seven more tea plots in non-traditional tea areas of Himachal Pradesh.

Advisory visits to the fields of ten flower growers at Sadhupul, Mahog and Ghaneta area were made. Planting materials and cut flowers worth Rs 29,000 were sold from the Floriculture Division.

Consultancy was rendered to M/s Fawn Aromatics, Chandigarh, and M/s Vimal Kaul, New Delhi, for setting up essential oil distillation units at Mandi and Bir.

Externally Funded Projects

The four projects sponsored, during the period, by DST/DBT/H.P. State Ministry of Health & Family Welfare with total budget allocation of Rs 6.653 million are:

1. DST-sponsored Project 'Viruses of ornamental plants, identification, culture, collection and phytoviro-informatics'. Sanctioned Budget Rs 0. 995 million (for 3 years)

2. DBT-sponsored project "Development and utilization of natural plant materials for economic upliftment of weaker sections and tribes of Himachal Pradesh'. Sanctioned Budget Rs 1.500 million (for 3 years).

3. DBT-sponsored project 'Biotechnology in Conservation of Economic Plant Diversity in Western Himalaya'. Sanctioned Budget Rs 3.243 million (for 3 years).

4. Ministry of Health & Family Welfare sponsored a project on 'Development and Cultivation of Medicinal Plants' with a sanctioned amount of Rs 1.000 million (for 3 years). ❑

Processes licensed and consultancy assignments taken up by CSMCRI

THE Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar's process on 'Low-density precipitated silica' has been licensed to M/s R. K. Marbles Ltd, Udaipur, through NRDC, at a fee of Rs 50,000. The process was demonstrated to Dr S. N. Wahy, Chief Executive Officer of the firm and its consultant Dr H. Dak. The firm intends to set up a 10 tonnes/day capacity plant based on the CSMCRI technology.

Consultancy Assignments

CSMCRI has entered into a consultancy agreement with M/s Dalal Consultants and Engineers Pvt. Ltd, Mumbai, for preparation of a feasibility report for solar ponds in Qatar. Shri K.M. Majeethia, Scientist F, visited Qatar to study the land and the concerned parameters.

A consultancy agreement has been signed with M/s Hindustan Salts Ltd, Jaipur, for the preparation of technical feasibility and economic viability report on Salt refinery project at Kharaghoda/Sambhar.

CSMCRI Interaction with Industry/R&D Organizations

The institute has held meetings with:

- Gujarat Mineral Development Corporation, Gandhinagar and INDEXTb, Ahmedabad, for collaboration on Organo-clays in Paint Formulation using Bentonite, available in plenty in Gujarat.
- Project Manager, Coastal Mapping Project, Space Application Centre, Ahmedabad, for the proposed project on Mapping of Seaweed Resources.
- Cellulose Products India Ltd, Ahmedabad, for developing processes for Seaweed-based Products. ❑

Mines, Metallurgy and Habitat Programme at RRL-Bhubaneswar

MINING and processing of minerals to meet the varied needs is a major activity being pursued by the mankind since ancient times. And to meet the growing demands of metals and mineral this activity has continued to increase rapidly, but with scant attention to environmental aspects. This has resulted in devastated forests, depleted soil and shattered landscape.

In the early eighties, the Regional Research Laboratory (RRL), Bhubaneswar, launched a massive effort, under the leadership of the then Director, Prof. P.K. Jena, to correct this anomaly by involving different concerned organizations like the Department of Mines, other mining establishments in Government as well as private sectors, a host of CSIR laboratories such as CBRI-Roorkee, CMRI-Dhanbad, CRRI-New Delhi, NEERI-Nagpur, etc. This integrated programme, 'Mines, Metallurgy and Habitat' (MMAHA) was formulated to bring about an all round development of the mines and the surrounding areas in such a way as to make them productive while retaining the environmental status with minimum damage. The state-of-art technology adopted covered the following areas: Mining, mine safety, beneficiation, pollution control; Utilization of mine wastes for integrated social development of surroundings like construction of low-cost houses, infrastructures like roads and township planning; Management of ground and surface water for social and agricultural use; Plantation of fast growing and economically important species on deforested land and dumps to restore the landscape and conserve natural environment.

The project was pursued in various climatic zones dealing with mining of a number of minerals like chromite mines of Sukinda valley and limestone mines of Mussoorie. The activities included maximizing ore output with safe mining practices like modifying opencast mine slopes with adequate drainage. In order to conserve high-grade ores and make use of lean ores, beneficiation and briquetting the fines were undertaken. Town planning, infrastructure and housing are integral parts of mining activities and the project helped some of the mining establishments in adopting modern scientific methods to save costs and utilize the wastes generated in mining. A huge quantity of groundwater, pumped out of the opencast chromite mines of Sukinda valley, contains hexavalent chromium and other heavy metals and is unfit for human consumption. A plant to treat this water for meeting the drinking needs of the township was developed and installed. Overall management of the vast water resources for irrigation and other uses also posed a challenge to the scientists. In order to stabilize the slopes and flats of the overburden dumps devoid of top soil, some of the native species were planted and nurtured leading to the survival of a thick forest cover in the region. Overall impact of mining on the environment including changes in air and water quality was studied thoroughly to understand the changes that mining brought in the physical features of the vast surroundings, and the water and air quality. A number of control measures were suggested to improve the situation.

For the survival of mankind, a balance in the environment has to be maintained as the mining goes on and the natural habitat has to be restored once the mining is over. MMAHA has demonstrated the viability of such a scheme for the first time by bringing a large body of professionals together to pool their resources and experience to work as a team. The landscape still bears the testimony to MMAHA's call and its success to inspire the future generations. □

Conference on Environmental Pollution Measures with Reference to Manufacture of Building Materials

AS a part of its Golden Jubilee Year programme, the Central Building Research Institute (CBRI), Roorkee, organized a conference on *Paryavaran Pradushan ke Paripeksh main Nirman Samagri* on 15 September 1997. Held in Hindi, the conference discussed the pollution problems related to building material manufacturing industries and the measures to combat this.

Seen on the dais at the inaugural function of 'Conference on Environmental Measures with Reference to Manufacture of Building Materials *(from left)*: Dr N.S. Bhal, Prof. R.N. Iyengar, Prof. Bharat Singh and Dr C.L. Verma

The Chief Guest on the occasion, Prof. Bharat Singh, ex-Vice Chancellor of University of Roorkee, inaugurated the conference. In his address, he opined that we would have to fight the pollution problems in our own way without sacrificing the developmental activities. But, he added, when doing so, we should not be cowed down by the West who have created a hue and cry about the pollution in developing countries, while they themselves in their developmental process have exploited natural resources and created pollution problems for the world. There, per capita pollution owing to energy consumption is 30 times more than ours. And when a country like ours uses its natural resources for its developmental activities, some of the countries there try to curb our developmental work in the name of pollution. He cited several examples in this context, leading to sordid unrest among the workers.

Prof. R.N. Iyengar, Director, CBRI, in his presidential address said that huge amount of consumption of energy in the industries manufacturing building materials creates environmental pollution. The institute has done a commendable work in abatement of pollution in brick and lime kilns by giving the industries pollution standards and pollution control packages. The institute has also done work on the utilization of industrial and agro-wastes for the manufacture of alternative building materials and components. This will help not only in conserving the scarce resources but also protect the environment.

About 150 scientists, technologists, entrepreneurs and academicians participated in the discussions. Twenty-three papers were presented. Proceedings of the conference have been brought out.

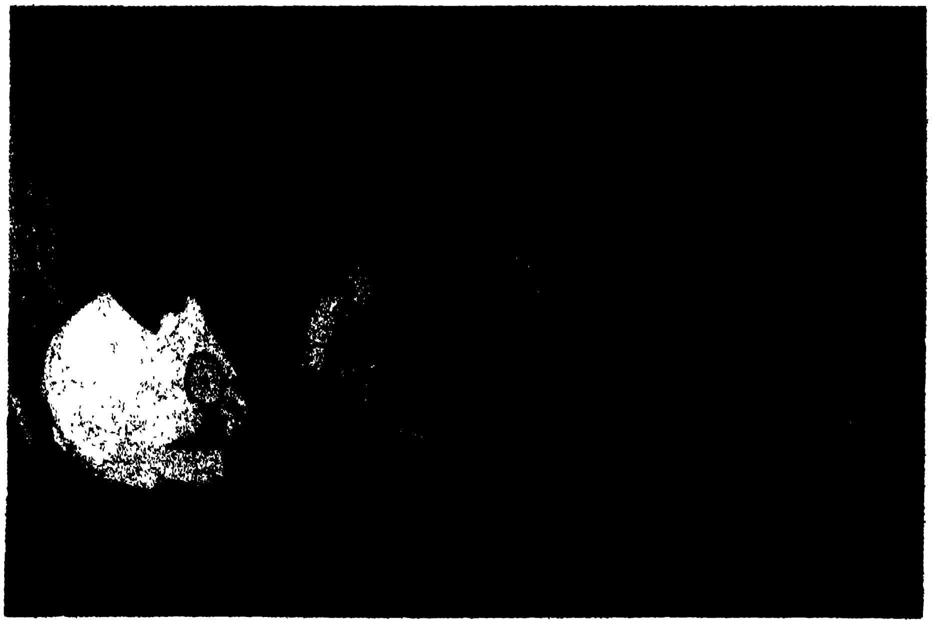
Dr N.S. Bhal, Dy. Director, welcomed the Chief Guest and the participants. Dr C.L. Verma, Organizing Secretary, thanked the sponsors of the conference. □

Chemical Engineers deliberate on Technology Upgradation

A one-day conference, organized by the Hyderabad Regional Centre of the Indian Institute of Chemical Engineers (IIChE) as part of its Golden Jubilee celebrations, on 24 August 1997, was attended by 200 participants from the various sectors of chemical industry and institutions like the Nuclear Fuel Complex, Indian Institute of Chemical Technology, College of Technology, Osmania University, India Drugs & Pharmaceuticals Ltd, and other agencies at Hyderabad.

Inaugurating the conference, Dr (Smt.) Reena Ramachandran, Chairperson of the Hindustan Organic Chemicals Ltd, Rasayani, stressed the importance of technology upgradation for India to become a global player in chemical sector. The transformation has to be brought in more than 6000 chemical companies in the country in small, medium and large-scale sectors. The significant strengths of Indian chemical industry in terms of its high growth rate of 15%; significant export performance in drug/pharmaceutical; agrochemical and other sectors; 16-18% value addition and ability to absorb new technologies, can be further enhanced through technology upgradation. She emphasized the need to respond positively to future challenges associated with the phasing out of eco non-friendly chemicals, downward trend of feed stock product prices, rationalization of inputs and outputs, management of technology under global competition, public concern about chemicals safety, etc.

Dr K.V. Raghavan, President, Indian Institute of Chemical Engineers and Director of IICT, in his presidential address identified the driving forces needed for technology upgradation in traditional process industry sectors and different connotations of technology upgradation from implementation angle. He stressed the need to give more attention to interactive linkage before technology, economy, environment, society and policies to achieve the goals of technology upgradation. He outlined the avenues available for the technology upgradation in small and medium sectors of Indian chemical industry.



Smt. Reena Ramachandran, Chairperson, HOCL, inaugurating the Conference of Chemical Engineers held at Hyderabad

Earlier, Prof. S. Venkateshwar, Osmania University, and Shri Ch Satyanarayana, Chairman of the local organizing committee of the seminar, welcomed the distinguished gathering. Shri S.M. Rao, Chairman, Hyderabad Regional Centre of IIChE, outlined the theme of the seminar and implications of the various aspects of technology upgradation and chemical engineering education. Prof. S.S. Sridharan of the Osmania University offered a vote of thanks.

The invited lectures were delivered by eminent scientists in three technical sessions. These included Prof. G.D. Yadav, UDCT (Mumbai); Dr Sadhukhan, BARC (Mumbai); Dr V. Srihari and Dr A.A. Khan, IICT (Hyderabad). Shri K.K. Sinha, Chief Executive, NFC; Prof. Bhagwantha Rao, OU; and Prof. S. Sadasiva Rao, Principal, College of Technology, OU; chaired these technical sessions. A panel discussion session on the challenges posed in technology upgradation to chemical engineers was also held under the chairmanship of Dr K.V. Raghavan. ❑

National Seminar on Aerospace Structures : NASAS

THE Seventh National Seminar on Aerospace Structures (NASAS) opened at the National Aerospace Laboratories (NAL), Bangalore, on 13 August 1997; NASAS now seems to be very well-established, and a major event on the aerospace calendar in India. The seventh NASAS had 250 registered participants and a programme packed with a large number of keynote and invited lectures.

Dr Kota Harinarayana, Programme Director (LCA), and the Chairman of 7th NASAS welcomed the paticipants and expressed his happiness at the overwhelming response to the seminar.

Prof. B, Dattaguru presented a brief overview of the first six NASAS meetings pointing out how each seminar devoted itself to a major theme in aerospace structures. The theme for 7th NASAS was 'Recent advances in structural dynamics and aeroelasticity'. Prof. K. Rajaiah introduced the Chief Guest and the seminar programme.

Inaugurating the seminar Dr K. Kasturirangan, Chairman, ISRO and Secretary, Department of Space, delivered an informative and inspiring lecture on the role of structural dynamics in satellite and space technologies. He discussed how finite (and boundary) element methods now play a pivotal role in aerospace structures technology, how digital computers and mathematical modelling have made a major impact and how composites structures have added an exciting new dimension to the field.

Dr Kasturirangan described the role of structural dynamics in the evolution of the INSAT and IRS satellite systems. The address concluded evoking interest in future technology trends in satellite systems (extended levels of flexibility, distributed actuators and sensors, improved platform stability for better imaging capability and propulsion-structures interactions).

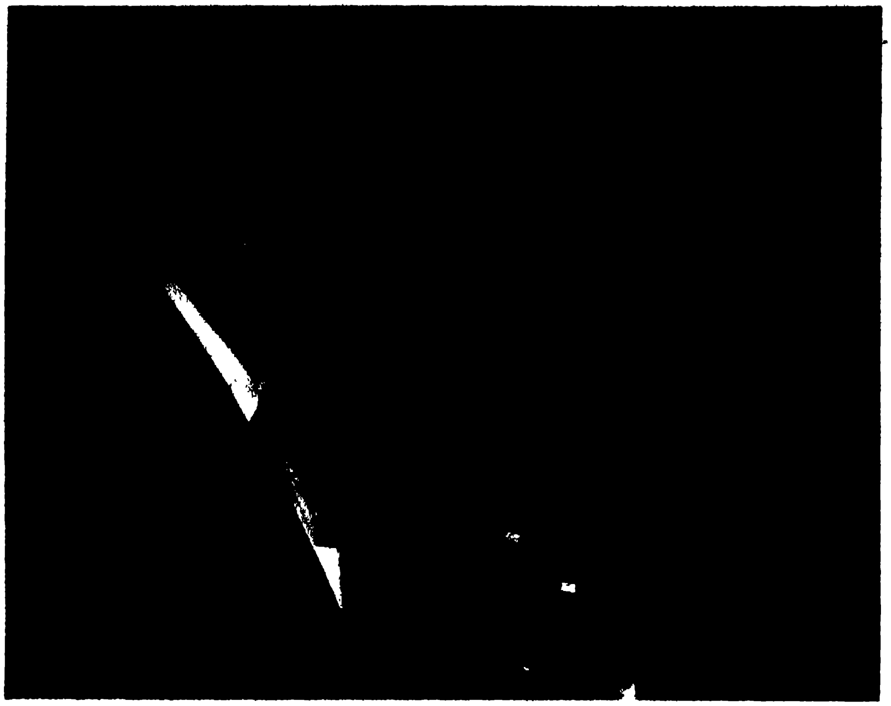
Dr B.R. Somashekar delivered his keynote address on 'Thirty-five years of vibration and aeroelasticity at NAL' on the occasion of his 60th birthday, as the 7th NASAS was being organized in his honour. Complimenting Dr Somashekar, Dr Kota Harinarayana said, "Dr Somashekar has played a key role in the development of structural technologies in India"; Prof. Rajaiah called him the "high priest in the field of structures"; Dr Kasturirangan lauded Dr Somashekar's "pioneering role in aerospace structures for over three decades" and for establishing capability "which has had a significant influence at the national level". Dr Prahlad saluted him for a "very distinguished innings at NAL" and praised Dr Somashekar's wonderful ability of handling a large number of managerial positions so well.

Dr A.R. Upadhya, ADA, proposed a vote of thanks and expressed his happiness that NAL was hosting the 7th NASAS: "After all, NAL is the birthplace of vibration and aeroelastic activity in India". In keeping with the trend established at the 6th NASAS, the complete proceedings volume (about 350 pages) containing the full text of the four special papers, 16 invited papers and 40 contributed papers were distributed among the participants. Shri C.G. Shah was the convener of the Organizing Committee of the seminar. ❑

Annual General Meeting of ISAME at NAL

THE eleventh annual general body meeting of the Indian Society for the Advancement of Materials and Process Engineering (ISAMPE), held at the National Aerospace Laboratories (NAL), Bangalore, on 12 August 1997, had a special keynote speaker: Prof. A. Brent Strong, International President of SAMPE, the American Society for the Advancement of Materials and Process Engineering. In his address, Prof. Strong commended ISAMPE's long history of technical competence and envisioned an expanding role for Indian technologies in world-wide manufacturing using advanced materials, such as fibreglass reinforced plastics and carbon fibre-reinforced products. "I trust that the relationship between SAMPE and ISAMPE will grow even closer with time", he said.

Surveying the world-wide advances in aerospace materials and products, Prof. Strong outlined the many markets where aerospace technology is being applied in non-aerospace applications. These non-aerospace markets include sports equipment, civil engineering structures (bridges, buildings, etc.), medical applications such as artifical limbs, and marine applications including materials for offshore oil rigs as well as boats and ship components. Prof. Strong also pointed out that the largest market for composite materials is in transportation, in-



Prof. A. Brent Strong addressing the Annual General Meeting of ISAMPE

cluding key components of automobiles and trains.

The inaugural address at the ISAMPE AGM was delivered by Dr K. Aprameyan, Chairman and Managing Director, Bharat Earth Movers Limited, Bangalore. Dr Aprameyan spoke of the key role of composite materials in the world today, calling this the "age of composites". The tone he set for the AGM was endearingly optimistic.

During the AGM, a felicitation function was held in the honour of Dr B.R. Somashekar, President, ISAMPE. Dr A.K. Singh, Head, Materials Science Division, delivered one of the invited lectures while this year's invited Annual Vijay Zaveri Memorial Lecture was delivered by Dr K. Ramchand, Director, Centre for Air Borne Systems, Bangalore. ❑

TRAINING PROGRAMMES

Physical Testing of Ceramic, Refractory Raw Materials and Allied Products

THE Central Glass & Ceramic Research Institute's Naroda Centre conducted a 10-day training programme on Physical Testing of Ceramic, Refractory Raw Materials and Allied Products during 1-12 September 1997.

The course had lectures on sampling of raw materials, sample preparation and aspects such as particle size distribution, pyrometric cone equivalent, refractoriness under load, thermal shock, permanent linear change, thermal expansion, etc. Important tests relating to the crockery ware, sanitary ware and tiles, namely crazing resistance, modulus of rupture, water absorption, etc. were demonstrated to the participants. A lecture discussed the requirements for setting up a physical testing laboratory in the ceramic units in the small-scale sector.

Five persons representing tile, bone china, electrical and technical ceramic industry attended the programmes. ❑

Production of Acid-resistant Bricks & Tiles

ANOTHER training-cum-demonstration programme conducted by the CGCRI Naroda Centre recently was on the 'Production of Acid-resistant (AR) Bricks and Tiles'. Held during 15-19 September 1997, the programme was attended by six participants from acid-proof brick manufacturing units in Gujarat and neighbouring states.

The programme had lectures on basic raw materials, their characteristics and specifications; compounding of bodies for acid-resistant bricks and tiles; methods of body preparation; drying and drying systems; firing of acid-resistant bricks and tiles; defects and their remedies in the production of these bricks and tiles quality control measures. The process parameters adopted for the preparation of acid-resistant bricks through wet grinding followed by granulation and pressing were demonstrated to the participants, from the stage of raw material selection to finished products. ❑

Prof. A.K. Raychaudhuri appointed Director, NPL

PROF. A.K. Raychaudhuri, Professor in the Physics Department of Indian Institute of Science (IISc), Bangalore, has taken over as Director, National Physical Laboratory (NPL), New Delhi, with effect from 1 October 1997.

Prof. Raychaudhuri was born in 1952 in Calcutta. After early education in Calcutta and Baroda he obtained his M.Sc. in Physics from IIT, Kanpur. He obtained his Ph.D. from the Cornell University, USA, in 1980, in the area of Low Temperature Physics. Immediately after his Ph.D., he joined the Max Planck Institute in Stuttgart, Germany, as an Alexander Von Humboldt Fellow. In 1982, he returned to India and joined the Faculty of the Physics Department of IISc, where he was a Professsor when he joined NPL.

Prof. Raychaudhuri's early research interest was in the area of low energy excitation in glasses and amorphous solids (known as Two level systems) which give rise to universal thermal and ultrasonic properties of glasses below 10K. In his Ph.D. work at Cornell he suggested the possibility of a physical relation between the low-energy excitation and the process of the freezing phenomena, which makes a glass from the liquid state. At Max Planck Institute, he pioneered a new class of high precision mechanical oscillator experiments in glasses down to millikelvin temperature range. These experiments triggered off a number of experimental studies in this field using this technique. This work published in 1984 is one of the most well-quoted references in this field and even today receives regular citations. A good summary of Prof. Raychaudhuri's contribution in this field was published as a review in 1986 in *Progress in Low Temperature Physics.*

On joining IISc, Bangalore, Prof. Raychaudhuri started the work of setting up his laboratory where one could make a large number of physical measurements down to temperatures below 1K. In a short time, he assembled a vibrant group consisting of a large number of research students, post doctoral research associates and project staff. In the last 15 years in Bangalore he succeeded in working on a number of topical problems in Solid State Physics and was able to attract large funding from different agencies. One of the major contributions Prof. Raychaudhuri made was in the area of electronic transport in metallic oxides at low temperature. The three main issues that he worked on are metal-insulator transition, superconductivity and colossal magnetoresistance. Prof. Raychaudhuri's group is one of the first groups in the world which started the field of colossal magnetoresistance. As a recognition of his work on low temperature studies on metallic oxides, he was awarded the Shanti Swarup Bhatnagar Prize in Physical Sciences in 1994. Prof. Raychaudhuri summarized his work of up to 1994 in this field in a review published in *Advances in Physics* in 1995. Since its publication, it has become a standard reference in this field.

In the last decade, Prof. Raychaudhuri has also made important contribution to the field of point contact spectroscopy and scanning tunneling microscopy/spectroscopy. The low-temperature high-vacuum scanning tunneling microscope or STM (working down to 4.2K) designed and fabricated by his group in Bangalore is the only instrument of its type in the country. His group was the first in the world to use these scanning microscopes to study the oxides showing colossal magnetoresistance. He is involved in a project to develop a UHV STM for use with the beam line of the pelletron in Nuclear Science Centre, New Delhi. In recent years, Prof. Raychaudhuri has developed the field of STM to study electronic properties of thin films at nanoscale. He would like to develop this new area into a viable tool for electronic industries particularly to study the problem of electromigration failure of metallic interconnects in IC chips. He has initiated a novel combination of STM and 1/f noise spectroscopy to gain insight into this practical issue which is of tremendous importance for reliability of electronic components.

Prof. Raychaudhuri has done a number of important developmental and consultancy projects for institutions like ISRO, BEL and was consultant to a number of private industries. He was selected to the national panel of experts for reviewing the design of cryogenic upper stage of GSLV of ISRO.

Prof. Raychaudhuri was heading the central cryogenic facility of IISc since 1993. The facility is a leading cryogenic centre of the country. In addition to producing more than 2 lakh litres of liquid nitrogen and 25,000 litres of liquid helium per year, it is also involved in a large number of major cryogenic R&D projects, including a pioneering technology mission project on cryogenic spice grinding. About 10 students have received their Ph.D. under his supervision in the last 15 years and seven others are registered with him currently. He has more than 110 papers in the best international journals of Physics.

Prof. Raychaudhri was also the coordinator of the integrated Ph.D. programme at IISc since 1994. He was one of the persons responsible for giving shape to this new type of academic programme which was started by IISc. He is referee for a number of international journals and is on the editorial board of *Pramanna* and *Current Science*.

Prof. Raychaudhuri has delivered a number of invited talks in conferences in India and abroad and chaired important sessions in international conferences. He was a Visiting Professor at Cornell University in 1989-1990 and at University of Maryland for 5 months in 1995.

In addition to the Bhatnagar Prize, he is the winner of the first N.S. Satyamurty Award of the Indian Physics Association and the Material Research Society of India medal. He was elected Fellow of the Indian Academy of Sciences in 1993.

Prof. Raychaudhuri believes in collaborative scientific programme of interdisciplinary nature where diverse research expertise can be pulled together to solve a problem. He had extremely successful collaborative programmes in the past. He thinks that his experience in initiating and leading collaborative scientific programmes will help him to consolidate the existing research activities and initiate newer activities at NPL. ❑

HONOURS & AWARDS

Dr M.V.M. Satyanarayana Rao

DR M.V.M. Satyanarayana Rao, Scientist, National Geophysical Research Institute, Hyderabad, has been awarded the 1997 Gold Medal by the Acoustic Emission Working Group (AEWG), India, affiliated to the Indian Society for Non-Destructive Testing, for his work on the application of Acoustic Emission (AE) technique.

Dr Rao has used acoustic emission to elucidate the mechanistic aspects of microstructural damage, and nucleation and growth of tensile micro-cracks in rocks of different categories.

He was a DAAD Fellow at the Ruhr University, Germany (1976-78), a Fulbright Fellow at the Pennsylvania State University, USA (1987-88) and a Science & Technology Agency Fellow at the Geological Survey of Japan (1990-91). He is a recipient of Young Scientist Award of the Andhra Pradesh Akademy of Sciences (1981). He worked at the National Institute of Rock Mechanics, KGF, from 1992 to 1995, and on the Indo-Japan S&T collaboration project on 'Evaluation of structural stability of a deep underground cavern by applying AE technology' during the period. He has set up sophisticated AE testing facilities at NGRI as well as the National Institute of Rock Mechanics, Kolar Gold Fields. He has many national/international publications to his credit. ❑

Dr Ch. Surinder, Executive Director, NPCIL, Mumbai, presenting the Gold Medal to Dr M.V.M.S. Rao

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit
Annual Subscription : Rs. 60
Editors : Dr B.C. Kashyap and Dr C.S. Gupta Editorial Assistant : Neelima Handoo Production : Kaushal Kishore Single Copy : Rs. 3.00
Phone : 5786301 Gram : PUBLIFORM Telex : 031-77271 E-mail: niscom@sirnetd.ernet.in. Fax : 5787062
RN 4512/57

ISSN 0409-7467

CSIR NEWS

R&D FLASHES

NAL-TEIL project for Hitachi, Japan completed

THE project to parallelize a Japanese computer code in quantum mechanics, jointly undertaken by the National Aerospace Laboratories' (NAL's) Flosolver Unit and Tata Elxsi (India) Ltd (TEIL), has been successfully completed. The 28-week project, which took off on 5 March 1997, has thus been completed right on schedule.

The project involved parallelization of over 20,000 lines of Fortran code on the Flosolver MK 4 and the 4-processor Power Challenge platforms. The NAL-TEIL deliverables to Hitachi include the source code with relevant files, a 44-page closure report, a user manual and sample outputs of most related cases. Two parallelization approaches were proposed, essentially based on the memory usage, and both yielded the correct results. The 'full memory' approach had a parallelizing efficiency of 90%.

The total project cost was about Rs 26 million. This success has not only established NAL as an important actor in code parallelization, but also allowed NAL teams to obtain first hand knowledge on a computer code of strategic importance. ❑

National Metallurgical Laboratory, Jamshedpur

Ceramic Tiles from Iron-Ore-Tailings of KIOCL

M/s Kudremukh Iron Ore Co. Ltd (KIOCL) is generating a huge amount of iron ore tailings. Under a sponsored programme, the National Metallurgical Laboratory (NML), Jamshedpur, has developed the technology to produce floor and wall tiles from these iron ore tailings. One hundred market size tiles in glazed and unglazed forms have been produced and supplied to M/s KIOCL for market evaluation. NML has also provided the necessary techno-economic data to the party for setting up a commercial plant.

Silicon Nitride-bonded Silicon Carbide Refractories for Blast Furnace

The objective of this project is to develop dense and high-strength silicon nitride-bonded silicon carbon refractories for the lining of blast furnace, particularly the lower stack, bosh & belly regions. The nitridation facility in the existing high-temperature electric furnace has been developed. The relevant raw materials have been procured from the indigenous source and experimental formulations developed. A few samples of 50 mm dia have been hydraulically pressed at an optimum pressure and their green properties studied. Further nitridation studies of these samples are in progress.

Thermochemical Analysis of Ferrochromium Production Process for Improving Product Quality and Process Economy at Bamnipal

A scheme based on a thorough thermochemical analysis of the chromite smelting process has been evolved for lowering the silicon impurity (%) in the ferrochromium produced at TISCO's 30 MVA submerged arc furnace at Bamnipal. The study showed that the solution to the problem of high silicon level in liquid ferrochromium calls for a break-up of coexistence of the contributing factors, namely free carbon and silica under very high temperatures (1800°C), either by eliminating the need for maintaining very high smelting temperatures, say by modifying the slag chemistry to bring down their liquids temperatures, or by adopting a two-stage process involving prereduction at relatively moderate temperatures and subsequently smelting the hot prereduced charge in an SAF. The latter scheme also offers substantial savings in energy consumption (about 1200 kWh/thm), coke consumption (200 kg/thm).

Fabrication and Supply of Laboratory Column to NMDC, Hyderabad

The NML Madras Centre's offer for the supply of 3" dia column flotation system has been accepted by M/s National Mineral Development Corporation (NMDC), Hyderabad. The Centre has won this contract against stiff global competition.

NML's column would be the first indigenous laboratory column to be commercially supplied in the country. The column incorporates many salient features like precise feed/discharge controls and level controls and is highly automated. The column has been utilized successfully for extensive feasibility studies in the laboratory as well as implant trials in various mineral processing industries during the last six years, namely, HCL, Malanjkhand; KIOCL, Kudremukh; GMDC, Kadipani; HZL, Agucha; and Bharat Gold Mines Ltd (BGML), KGF.

Based on the feasibility studies on iron ores utilizing NML's 3" dia column, M/s Kudremukh Iron Ore Co. Ltd, Kudremukh, has put up 4 m dia column which is working satisfactorily.

HZL is installing two columns of 1.5 m dia each for their Dariba lead/zinc ores, based on the feasibility studies carried out by NML with its 3" dia laboratory column at their plant.

Semi-commercial/pilot column (0.5 m dia) in operation at BGML

NML has recently carried out extensive laboratory feasibility studies at BGML on their gold ores with excellent metallurgical results. On BGML's request to carry out pilot trials, NML installed its 0.5 m dia column at BGML and demonstrated the reproduceability.

At GMDC-Kadipani, NML laboratory column has been used to carry out the feasibility studies for fluorspar beneficiation. The results were very encouraging and NML is presently testing its 0.5 m dia column in the cleaner circuit of the plant.

Column Flotation Technology for Beneficiation of Indian Ores/Minerals

The NML Madras Centre has successfully developed the column flotation for the beneficiation of Indian ores/minerals. The Centre designed and developed a 3" dia fully automated laboratory column flotation cell and carried out extensive feasibility studies on various industrial minerals like copper, lead, zinc, gold, fluorspar and iron ores both in the laboratory as well as at various plants.

The Centre's studies have established the feasibility of adoption of column flotation technology in the cleaner circuits for copper, lead, zinc, iron ores and fluorspar. The feasibility studies have led to the design of 0.5 m dia column. The Centre has tested the pilot column in the rougher flotation circuits at Bharat Gold Mines Ltd (BGML), Kolar Gold Fields, and demonstrated the applicability of the technology.

The gold concentrates produced assayed 60-80 g gold/tonne with good recoveries as compared to 8-10 g gold/tonne in their conventional flotation operations. Column flotation technology offered by NML is expected to improve the overall economics of gold production of BGML.

NML pilot column is presently under test at GMDC, Kadipani, in the fluorspar beneficiation plant. According to the feasibility tests of NML, 6 conventional flotation stages can be replaced by 2 columns series to achieve 97% grade of CaF_2.

Beneficiation of Limestone for Cement Industry

The NML Madras Centre has suggested to M/s ACC Ltd, selective flotation of silica for the limestone using amines and successfully demonstrated the technology for their Madukkarai limestone.

Beneficiation of limestone for cement manufacture is practised in the country only by M/s Associated Cement Companies Ltd, in two of its operations (Madukkarai and Chaibasa). Flotation of limestone is practised in these operations to produce a limestone rich float using fatty acids. The Centre has suggested selective flotation of silica for the limestone using amines and successfully demonstrated the technology for their Madukkarai limestone. NML has also established at laboratory scale the overall economics of the process and the benefits to M/s ACC Ltd. Plans are underway to demonstrate the technology at 8-10 tonnes/h scale to M/s ACC Ltd at their Madukkarai plant.

The Centre recently established the feasibility of washing the limestone rejects of M/s ACC Ltd, to recover the valuable carbonates contained in them on 2 tonnes/h scale. The technologies of washing and reverse flotation are expected to improve the overall economics of M/s ACC's operations.

Flotation Column for Industrial Applications

Encouraged by the success of its 75 mm dia, fully automated column and the excellent metallurgical results obtained using the column, NML recently designed and developed a semi-commercial column of 0.5 m dia with a capacity to treat 2-4 tonnes of ores per hour. This column has complete instrumentation for level control, wash water control, automatic sampling, etc. It incorporates a special sparger designed and developed at the Centre. The sparger consists of special sintered tubes capable of producing fine and uniform air bubbles at relatively low air pressures of 2-5 kg/cm^2. The sparger tubes can be removed and repaired for any clogging while the column is in operation. As mentioned earlier, the 0.5 m dia column has been successfully tested for Bharat Gold Mines Ltd at Kolar Goldfields for their gold ores and for M/s Gujarat Mineral Development Corporation, at Kadipani for their fluorspar.

Flaky Stainless Steel Powder

M/s Euroflux Transmission (India) Pvt. Limited, Hyderabad, has shown interest in manufacturing the paint based on paint-grade stainless steel powder and its marketing, especially in the coastal regions of the country. To make paint-grade stainless steel powder, the steel powder produced through chemical route has to be flaked similar to Al/Zn flakes. The routes followed in making Al/Zn flakes are not at all suitable for making flaky stainless steel powder. Even if these routes are used in making flaky powder, the production usually takes 4 to 5 times more time, which is highly uneconomical. Earlier, NML had developed a process to make stainless steel powder from sheet/sheet scraps, etc, through a chemical route. The powder obtained however is globular in nature and can not be used as pigment for paint formulation because of its limited surface area and high density.

In view of the above, the laboratory has developed a new process for making good quality flaky stainless steel powder, which is quite fast and highly economical. The paint based on flaky stainless steel powder was coated on: (1) bare mild steel belt polished, (2) mild steel etched surface, (3) mild steel phosphated, and (4) rusted mild steel. The coating on mild steel phosphated/etched/belt polished shows a reduction in corrosion current by about 500 times (nanoscale) in 3.5% NaCl solution as compared to uncoated mild steel. On rusted surface, it is 100 times less (microscale). This indicates that the coating so developed is highly corrosion resistant and would be very effective for protection of structural steels in coastal regions.

Pre-concentration of Uranium Ore by Froth Flotation

The uranium ore is the basic raw material for a nuclear energy programme. In India, uranium ore is processed essentially by the hydrometallurgical route. The conventional process involves sulphuric acid leaching of uranium from the ore, ion-exchange concentration followed by precipitation of uranium as magnesium diuranate. However, the conventional direct leaching method is considered relatively costly, and this also leads to environmental pollution problems. Scope exists for using physical beneficiation methods for pre-concentration of the low-grade uranium ores. Development and adoption of the physical-cum-chemical beneficiation process is expected to reduce the acid consumption in leaching of the low-grade ores and would also be helpful in safe disposal of tailings.

In Meghalaya, occurrence of sandstone type uranium mineralization is reported from Domiasiat. Studies on various aspects of this deposit are being pursued by the Department of Atomic Energy, for its economic exploitation. In this connection, M/s Uranium Corporation of India Ltd (UCIL), Jaduguda, approached NML for conducting bench scale froth flotation studies on a low-grade uranium ore sample from Domiasiat.

It was envisaged that froth flotation process would be helpful in pre-concentration of the ore, reducing the load on the downstream hydrometallurgical extraction of uranium and rejection of the major portion of the gangues as tailings in environmentally acceptable form.

The low-grade ore sample used for the detailed flotation studies assayed 0.052% U_3O_8. Flotation experiments were carried out with varying the various process parameters, using potassium amyl xanthate and cupferron as the collector for uranium bearing minerals. The flotation pre-concentrate weighed about 35% with over 90% uranium recovery. Flotation with the classified and deslimed feed also resulted in the similar metallurgical results.

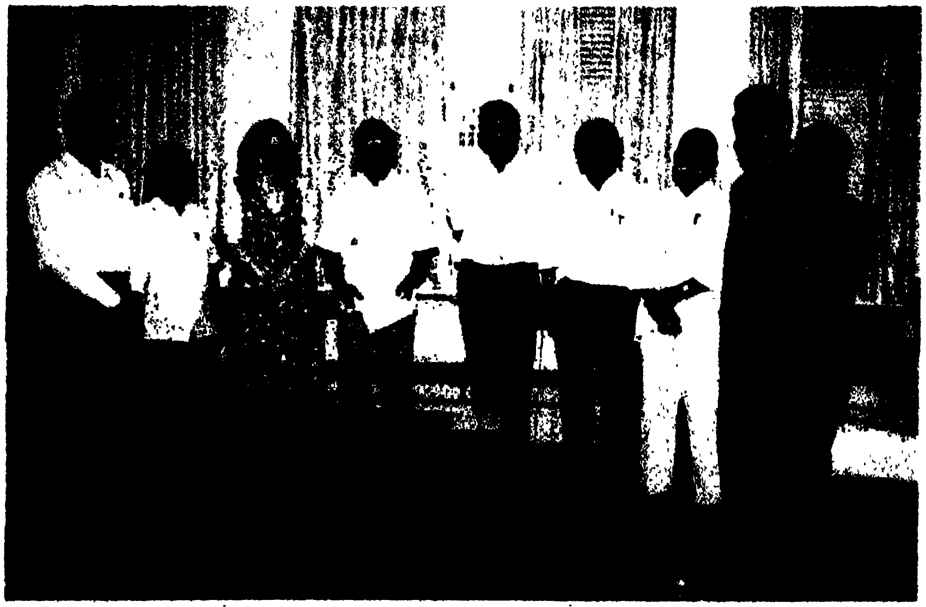
Considering the high cost of cupferron diethyl hexyl phosphoric acid, alamine 336 and tri-butyl phosphate were tried as alternative reagents in combination with light diesel oil and xanthate. This also resulted in reasonably high recovery of uranium values in the flotation pre-concentrate.

The flotation studies were extended to the leach residue sample assaying 0.092% U_3O_8. In comparison to low-grade ore, this sample showed better flotability. The flotation pre-concentrate from the leach residue sample weighed about 29% with 96% recovery of uranium values. Sufficient quantities of the pre-concentrates were prepared using both low-grade ore and leach residue sample through large batch experiments and supplied to M/s UCIL for subsequent leaching studies.

The present study has shown the efficacy of flotation based process for the pre-concentration of low-grade Domiasiat uranium ore. ❑

IICT signs agreement with ICI Polyurethanes (Belgium) and ICI (India) for development of process know-how for polyols composite panels

THE Indian Institute of Chemical Technology (IICT), Hyderabad, has entered into an agreement with Imperial Chemical Industries (ICI), Belgium, and ICI (India) Research and Technology Centre, Mumbai, to develop process know-how for the production of composite panels made of polyols prepared by using agro-based renewable raw materials and reinforced with natural fibres.



Dr (Ms) Lieve Vanoverloop during IICT's signing the agreement with ICI Polyurethanes (Belgium) and ICI (India). Others seen in the photo include: Dr M. Yaseen, Head, Organic Coatings Division; Dr K.V. Raghavan, Director, IICT and Dr M.M. Mahendru of ICI India, Res. & Tech. Centre

The project is to be undertaken in two phases, viz. (i) Raw materials identification and their standardization, as well as preparation and characterization of polyols and their reaction with other reactive components; preparation of composite panels and their characterization and (ii) Performance evaluation of reinforced composite panels; preparation of composites on pilot plant scale and finalization of techno-commercial report.

The duration of the project is two years. This project will enable ICI to employ cost-effective technologies for producing composite panels. ❑

CSIR Foundation Day Celebrations at Labs/Institutes

THE main function to celebrate the CSIR Foundation Day this year was covered in the 15 October issue of *CSIR News* (p. 273). Presented here are the highlights of celebrations at some of the CSIR constituents.

Central Building Research Institute (CBRI), Roorkee

The CSIR Foundation Day Lecture was delivered at CBRI by Col. S.P. Wahi, former Chairman, ONGC, on 'Achievements since Independence'. In his lecture he lauded CSIR for its vital contributions to the industrial revolution in the country during the past five decades. He also complimented CBRI for valuable contribution by providing know-how for producing building materials/components from industrial wastes, and in disaster mitigation, structural and foundation engineering.

He also spoke about the threat of multinationals, technological gaps, leadership vacuum and infrastructural bottlenecks, and presented mementoes to CBRI employees for completing 25/30 years of service and to those who had retired during the past year.

An assessment of R&D activities during the past year was made, which showed that the institute continued to do pioneering work on development of value-added products from the industrial and agrowastes. Laboratory and field trials were conducted for the production of full-size slag-lime bricks by vibro-compaction technique. Technical assistance and guidance was provided to M/s Rhythem Construction Pvt. Ltd, Vijayawada, in commissioning of the plant for manufacture of clay flyash bricks. At the request of GOC, Infantry Division, process detail was provided to produce stabilized mud bricks from calcareous hilly clays, for use in Leh and Laddakh. Investigation for soda ash industrial byproduct wastes for making building bricks and tiles was undertaken. Performance and durability of multiblend cement and utilization of industrial waste in the development of masonry cement and their long-time behaviour is being studied. Work on leachability of toxic metals immobilized in cementitious materials, and a collaborative project with other CSIR laboratories on the development of reference materials were continued. A new project on development of a continuous type gypsum calcinator was taken up.

Also, work on fire resistance of structure in pre- and post-fire investigation was started. Suitable designs for housing complex for the National Institute for the Visually Handicapped (NIVH), Dehra Dun, have been suggested. The institute has also taken up investigation and remedial measures pertaining to distress in Raj Bhawan Complex, Goa. On the request of Navodaya Vidyalaya Samiti, Ministry of HRD, Government of India, feedback studies on the performance of complexes of Navodaya Vidyalayas constructed so far throughout India was taken up.

These are just a few examples of in-house R&D work and sponsored projects undertaken by the institute, which are in progress at various stages.

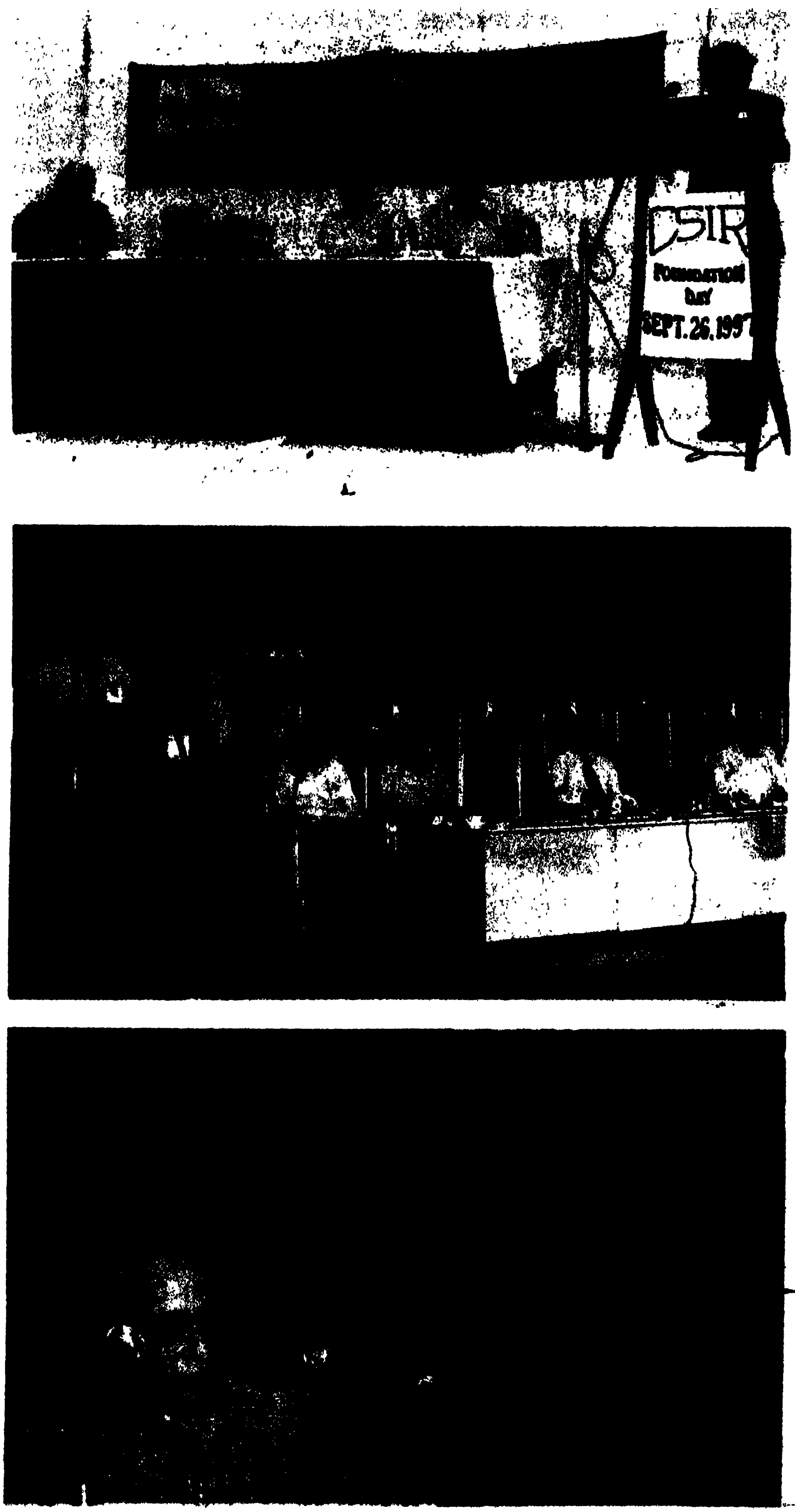
The institute is celebrating the year 1997-98 as its Golden Jubilee Year. Under the celebration programme, the institute arranged a meet with the industry in the month of March 1997 and a national conference on environmental pollution measures in reference to building materials on 15 September 1997. Another Golden Jubilee National Seminar on 'Natural hazards in urban habitats' was held on 10-11 November 1997 at Delhi.

Central Electrochemical Research Institute (CECRI), Karaikudi

At CECRI, Prof. R. Natarajan, Director, Indian Institute of Technology, Chennai, delivered the CSIR Foundation Day lecture on 'Some Current Issues in Energy and Environment'. In this lecture he pointed out, "It is important to recognize that about one half of the energy consumed in India is non-commercial energy, comprising firewood, dung and agricultural waste products. The world has already witnessed a decoupling of energy and economic growth. Between 1973 and 1985, the total energy use per capita in the OECD countries fell by 6% while the per capita GDP increased by 21%. Such decoupling is expected to continue in the future, both because of ongoing structural shifts in their economies and opportunities for more efficient use.

Regarding the use of solar energy, Prof. Natarajan observed, "Collection of solar energy involves the use of large amount of energy-intensive materials and processes, such as aluminium, glass insulation, etc., rendering this a 'parasitic' energy resource. But solar energy is clean, safe, free and virtually inexhaustible. In less than three days, the solar energy reaching the earth matches the estimated total of all fossil fuels. Solar energy can be effectively utilized to solve all energy problems and provide future life style in harmony with ecosphere, he added.

Presiding over the function, Prof. G.V. Subba Rao, Director, CECRI, said that CSIR has the capabilities and technologies to compete with the world market in R&D, and this has been given a boost by the liberalization policy. "CECRI has done excellently well with regard to R&D and ERG during 1996-97. The institute has assisted 200 small-scale entrepreneurs, passed on 11 processes to the industry by direct trans-



CSIR Foundation Day lectures by Col. S.P. Wahi, former Chairman, ONGC, at CBRI (*top*); Prof. R. Natarajan, Director, IIT, Chennai, CECRI (*middle*); and Shri A.K. Singh, General Manager, TISCO Collieries (being read by Shri K.L. Sharma, Dy. General Manager, TISCO Collieries), at CFRI.

fer, and filed 12 patents. Four new technologies have been developed and 23 sponsored and grant-in-aid projects to the tune of Rs 16 million completed. Thirty-one projects are in progress. Corrosion audit and on-line monitoring of major structures of various industries have been undertaken. Also, Corrosion Map of India is being prepared in collaboration with the National Corrosion Council of India, he disclosed.

Shri S.V.N. Nagappan, President, Chamber of Commerce and Industry, Karaikudi, released a brochure on 'Industrial Metal Finishing' brought out on the occasion.

Thavathiru Ponnambala Adigalar of Kundrakudi, Prof. Natarajan and Prof. Subba Rao gave away the prizes/mementos to the CECRI scientists and their wards for meritorious contributions/participation in the various competitions organized on the occasion.

Central Fuel Research Institute (CFRI), Dhanbad

The CSIR Foundation Day lecture of Shri A.K. Singh, General Manager, TISCO Collieries, was read out, *in absentia*, by Shri K.L. Sharma, Dy. General Manager. In his lecture, Shri Singh pointed out that the world energy demand depends on the trends of economic growth, extent of industry and the energy policies adopted. Energy being a key input, the per capita consumption of energy is taken as an indicator of development. The primary energy requirement of world has increased from 6.36 billion tonnes of oil equivalent (B toe) in 1982 to 7.79 to 7.79 B toe in 1990. Of this, the share of coal was 28% and that of the oil and natural gas together 62%. The rest was from nuclear and renewable sources. On the basis of present trends, the energy requirements of the world by AD 2020 is expected to be of the order of 13 B toe.

In the section of non-renewable sources of energy, the projected growth in the contribution of coal comes next to natural gas. The estimated reserve of coal in India up to a depth of 1200 m is 202 billion tonnes and is expected to go up further in future with further exploration of resources by GSI. Indian coal is predominantly of higher ash content by about 20 to 30% than the power grade coal. For economy, efficient operation and for environmental clearance of coal-based power projects (installed capacity exceeding 500 MW), it is now being considered important to establish pit-head washeries for non-coking coal. Such power houses will have to be linked to pit-head coal washeries, Shri Singh added.

Shri Singh pointed out that in view of the favourable geological configuration of coal reserves in India, it is possible for the coal industry to supply one of the cheapest fuel resources to the economy, closely competing with natural gas. The long-term cost of coal would increase with progressive depletion of coal reserves.

Shri Singh further said that in the coming decades the environmental issues will appear as dominating factors. The worldwide concern for environment and our own national concern will set the pattern of structural reorganization required for meeting the requirement of desired quality of environmental management.

Opencast mining affects the environment severely, more so in the forest areas. It is anticipated that land degradation per year due to coal mining will be of the order of 1500 hectares by 2001- 02. Laws are becoming strict in this regard. Unless suitable and effective measures are taken during mining operations, it will not be possible to go in for large projects.

For the project-affected persons, proper rehabilitation action plans have to be prepared and undertaken. The objectives of resettlement and rehabilitation measures should be:

(i) To minimize disturbance to local population.

(ii) To improve the standard of living and earning capacity of project-affected people.

(iii) To provide adequate opportunities and resources to the project-affected people to share benefits from the projects.

While energy consumption increases industrial growth rate, it also leads to environmental pollution. Clean coal technology refers to a new generation of advanced coal utilization technologies that are environmentally cleaner, and in many cases, more efficient and less costly. These are: (1) Integrated Gasification Combined Cycle (IGCC), (2) Integrated Gasification with Fuel Cells (IGFC), (3) Pressurized Fluidity Bed Combustion Cycle (PFBC), and (4) Direct Coal Fixed Turbine (DCFT).

Increased use of high-ash coal is causing serious concern and anxiety due to the problems associated with the emission of greenhouse gases. To combat such serious problems and reduce the impact of environmental hazards, it is essential to adopt suitable technology for improving the combustion efficiency in Power House boilers by using beneficiated coal.

In the context of liberalized economic situation, coal can be imported under Open General Licence (OGL). Further captive mining of coal by outside parties is expected to add to the coal availability. As a result, nationalized coal industry has to face competition from the import of overseas coal as well as private mining industry. It is in this context that Indian Coal Industry, especially the nationalized one, has to sharpen its cutting edge, be more efficient operationally, economically and in all other respects. It has also to ensure supply of correct quality of coal under more stringent terms and conditions. Beneficiation of coal at a competitive price thus becomes an unavoidable imperative instead of exception. For its growth, India has no option but to depend on its coal resources for exploitation, Shri Singh concluded.

The staff members who had completed 33 years of service were presented with mementoes.

Dr K.S. Narasimhan, Director, CFRI, delivered the welcome address. Shri P.K. Bandopadhaya, Seniormost Deputy Director, proposed a vote of thanks.

Central Mining Research Institute (CMRI), Dhanbad

The Foundation Day lecture of Shri S. K. Sen, Chairman-cum- Managing Director, Northern Coalfields Ltd (NCL), delivered by Shri S.K. Lal, G.M., NCL, dealt with environmental management of large-scale openpit mining operation and concluded that environmental consideration should be incorporated from the very beginning of any project to minimize degradation of environment owing to mining and ensure sustainable development.

Dr T.N. Singh, Acting Director, CMRI, delivering his welcome address during CSIR Foundation Day celebrations at CMRI. Sitting on dais (from left) are: Dr C. Bandyopadhayay, Dr P.R. Sheorey, Prof B.B. Dhar and Shri S.K. Lal.

Earlier, while welcoming the guests, Dr T.N. Singh, Acting Director of CMRI, stressed that the development of a country mainly depends upon the advancement of science and technology. He expressed that the advancements in science should lead to the development of technologies and upliftment of the society.

Prof. B.B. Dhar, Head, Department of Mining Engineering, BHU, and former Director of CMRI, expressed that India's infrastructural facilities are very strong and as a result, even the foreign companies are interested to invest in this country. He opined that due to globalization, Indian coal has to be decontrolled and, as a result, the future of CMRI is expected to be very bright.

Prof. Dhar also presented the awards/mementoes and released a folder 'CMRI at a glance'.

Central Scientific Instruments Organisation (CSIO), Chandigarh

Prof. K.L. Chopra, former Director of IIT-Kharagpur, delivered a lecture on 'Nano Science and Nano Technology' covering the wonderful and far reaching applications in the various realms of science and society.

Prizes and mementoes were distributed by Prof. S. Mohan, Director, CSIO.

Indian Institute of Petroleum, Dehra Dun

CSIR is one of the leading R&D organizations in the country. It has placed India among the few countries which are entering the global arena for collaborative research and technology marketing. The landmark achievements of CSIR, since its creation in 1942, were highlighted by Shri C.R. Prasad, Chairman and Managing Director of Gas Authority

Shri C.R.Prasad, Chairman, GAIL, inaugurating the CSIR Foundation Day Celebrations at IIP; and School students being told about an instrument at CSIO

of India Ltd (GAIL), while delivering the CSIR Foundation Day lecture at IIP.

Mentioning about the major achievements of IIP, Shri Prasad described this institute as one of the precious 'jewels' among the CSIR constituents. This institute, he pointed out, is the nucleus for petroleum research in India and almost every Indian refinery today has a technology licensed from here.

He informed that GAIL was planning to set up at its Vaghodia plant the first commercial unit to convert ngl to valuable LPG and gasoline, utilizing the ntgg technology of IIP. IIP and GAIL would hold joint process license for this technology, he added.

IIP Director Dr T.S.R. Prasada Rao spoke at length about the crucial role of CSIR towards the economic upliftment of the country and bringing about excellence in basic research. The CSIR labs, he said, publish over two thousand scientific papers and file 250 patents every year. Bilateral scientific collaborations exist with 21 countries, of which nine are developed and twelve developing countries.

Talking about IIP, Dr Prasada Rao said, the institute's strength was its technologies and intellectual property, which have enabled it to earn about 70% of its CSIR budgetary grants, from industry and other organizations. In 1997-98, the institute hopes to earn 120% of its budget from CSIR. The institute had won the CSIR Technology Award five times since 1990, when this award was instituted. The anticipated two-fold increase in the present refining capacity, stress on newer quality levels of transport fuels and the widening demand and supply gap for fuels presented stiff technological challenges for the IIP scientists, he added.

The GAIL CMD, Shri Prasad, also gave away the prizes. Shri Raghubir Singh Gaharwar, a senior scientist of IIP, proposed a vote of thanks.

Industrial Toxicology Research Centre (ITRC), Lucknow

The CSIR Foundation Day lecture at ITRC was delivered by Prof. N.K. Ganguly, Head, Department of Experimental Medicine and Biotechnology, PGI, Chandigarh. He informed that *Helicobacter pylori* has been identified as one of the aetiobytic agent in peptic ulcer. A decapeptide from this organism has been designed which modulates acid secretion in parietal cells of the stomach and also releases inflammatory cytokines from lymphocytes by a separate docking mechanism. Also, a hypothesis has been proposed through preliminary studies that the same inflammatory cytokines could be generated in patients of coronary artery disease thereby escalating the process. This may pave a way for new drug design.

Presiding over the function, Prof. Ramesh Chandra, Vice Chancellor, Lucknow University, expressed his happiness to note that ITRC was engaged in several National Programmes. He made a special mention of the ITRC's contributions to the Drinking Water Mission under which it had developed kits for water disinfection. He also praised the role of ITRC in the field of environmental sciences.

Earlier, Dr P.K. Seth, Director, ITRC, introduced the distinguished guests to the audience. He also informed that ITRC had oriented its

Dr P.K. Seth, Director, ITRC, presenting memento to Prof. N.K. Ganguli, Prof. & Head, Deptt. of Experimental Medicine and Biotechnology, PGI, Chandigarh, during CSIR Foundation Day Celebrations. Dr Ramesh Chandra, Vice Chancellor, Lucknow University, Lucknow, is in the middle. Photo on the right shows school children visiting exhibition organized by ITRC

activities keeping in view the current needs. New areas in modern immunology, neurochemistry and molecular biology have been introduced. Short-term test systems have been adopted which would help in toxicity testing of chemicals, avoiding the use of animals to a large extent.

Mementoes/awards were given to the ITRC personnel for their services, and children for winning the essay competition organized on the occasion.

National Aerospace Laboratories (NAL), Bangalore

A highlight of the NAL and CSIR Foundation Day functions in recent years is that the audience gets the pleasure of listening to two lectures: the customary Foundation Day lecture plus the NAL Technology Lecture (on the NAL Foundation Day) or the NAL Business Lecture (on the CSIR Foundation Day).

This year's CSIR Foundation Day Lecture, titled 'R&D Management in the Indian Context: Prospects and Challenges', was delivered by Dr M. Rammohan Rao, Director, Indian Institute of Management, Bangalore. The Second NAL Business Lecture was delivered by Dr B.R. Pai, Head, Propulsion Division, on 'Non-conventional Energy Systems: R&D at NAL'. Dr K. N. Raju, NAL's former Director, presided over the function.

Dr T.S. Prahlad, Director, welcomed the gathering. Being CSIR's Foundation Day, Dr Prahlad's opening remarks focused on the future role of CSIR. "CSIR is a very big organization and, by any reckoning, a very significant S&T work force in India. How are we to realize CSIR's full potential?", Dr Prahlad asked, "and is a market-oriented strategy the best bet for CSIR?".

A very illuminating and articulate perspective on this question was provided by Dr Rammohan Rao in the course of his CSIR Foundation Day lecture. "It is now widely accepted that increases in labour force and capital alone cannot completely account for the economic growth of a country. There is an unaccounted 'growth factor' which has been variously characterized as 'technology improvement', 'increasing efficiency of labour', 'knowledge accumulation' or 'investment in human capital", Dr Rao said in his opener. And what one found surprising was that the estimated contribution of this growth factor (called total factor productivity, or simply TFP) to the GDP could range between 11-52% in the rich (G7) countries and go up to 30% in the East Asian countries. These figures suggest that we (and especially CSIR) must take TFP very seriously.

Dr Rammohan Rao then went on to discuss a wide variety of possible indices to measure the economic well-being of a country and reached the worrying conclusion that whatever be the index, the Indian performance is 'dismal'.

Analyzing the reasons for this poor performance, Dr Rao made the telling comment that "It is one thing to have access to technology and knowledge; it is quite another to exploit these technological advances". "The ability to effectively exploit technological advances depends crucially on investments in education and training", Dr Rao said.

Dr Rammohan Rao's lecture was therefore an eye-opener in many ways. One particularly enjoyed his homilies as he switched from one part of the lecture to the next. Samplers: "economists like to reduce everything to one number"; "one can't ignore this business of ranking everything because people pay attention to such things!"; "the days of leisurely pursuit of knowledge are probably over" or "we can complain, but we can't fight the market".

Today's challenges, according to Dr Rao, are the following; linkages, continued improvement, modular design for mass customization, shrinking technology life cycles, concurrent engineering and reduction of the time taken to introduce products — challenges which CSIR would do well to face!

Dr Pal's NAL Business Lecture was a remarkable summary of NAL's R&D effort on renewables; in wind energy, in solar energy, in geothermal energy and in energy from natural gases. "We must press on with renewables, because they are the hope of the future", Dr Pai said. Dr Pai also highlighted certain facets of the problem which are significant but often ignored: "we spend a lot of effort to set up a good power plant, and then spoil it all by failing to develop the machinery to keep it operational!", he said. ❑

Good Laboratory Practices

GOOD Laboratory Practices (GLPs) are a cost-effective management system to assure the quality and integrity of laboratory studies, global uniformity of research protocols, prudent utilization of resources, completeness and authenticity of research reports verifiable by independent monitors, and global acceptability of data/reports by regulatory authorities of international partners in technology and trade. A number of countries have passed legislation to manufacture, transport, trade and use substances with implications to human health and environment. It is obligatory, therefore, that international trade of such materials and technologies meets the GLP standards for regulatory clearances.

The Council of Scientific and Industrial Research (CSIR) strives for the highest international standards of quality and verifiable integrity of its R&D data, reports and technologies The laboratories have been following the standard practices of keeping the records of the studies being performed by them. The following of GLPs, however necessitates the training and retraining of the staff. Accordingly, two Advanced Training Courses on GLPs were organized during 29-31 August 1997 and 1-3 September 1997, at Industrial Toxicology Research Centre (ITRC), Lucknow.

The first Training Programme was inaugurated on 29 August 1997 with Dr V.P. Kamboj, eminent scientist and former Director of CDRI, Lucknow, as Chief Guest and Dr T.P. Suresh, General Manager (Regulatory Affairs), Rallis India Ltd, Bangalore, as Expert Consultant/Course Director. The inaugural function started with a welcome address by Dr P.N. Viswanathan, Scientist F, ITRC, followed by introductory remarks by Dr O.P. Agarwal, Joint Adviser, RPBD, CSIR-HQ, New Delhi, on the genesis and CSIR viewpoint behind organization of such training courses for scientists and technologists in the CSIR system. In his inaugural address, Dr

Inaugural function of Advance Training Programme on Good Laboratory Practices

V.P. Kamboj, emphasized the changing scenario in national and international trade, accountability in scientific and technological exchanges, legal obligations to industry and consumers and mandatory documentation/archiving for audit verification which are achievable through GLP implementation. A vote of thanks to the Chief Guest, invited dignitaries, delegates, organizers and audience at large was proposed by Dr D.K. Agarwal.

The technical sessions of the programme were conducted by Dr T.P. Suresh, Course Director. The participating scientists and technologists from eight CSIR labs were introduced to basic principles of GLP, model examples of study plans required for GLP compliance, and contents of study plan for its formulation before conducting any regulatory study. In the follow up, five groups of participants were made and specific study titles were allotted to each group for practical training on formation of study plans. The study plans of each group were analyzed systematically by Dr Suresh, to indicate their suitability, deficiencies and requisite improvements for GLP compliance.

The following day (30 August), basic principles of formulating Standard Operating Procedures (SOPs) were discussed with model examples and then each participant was given a specific subject title to prepare an SOP independently. Like study plans, each SOP was discussed and analyzed indicating merits and deficiencies, suggesting improvements. The practical exercise helped the participants to learn and formulate their own study plans and SOPs with more confidence.

The third and final day (31 August) of the first training course witnessed reanalysis of study plans/SOPs, problem solving, and general discussions pertaining to GLP compliance in regulatory studies vis-a-vis basic R&D work in CSIR labs. Dr Suresh allocated more specific titles of study plans and SOPs to each participant which will be analyzed and discussed in upcoming workshop at Hyderabad.

The session ended with thanks to the Course Director and organizers.

The second consecutive training programme on GLPs was inaugurated on 1 September 1997 with Dr R.C. Srimal, eminent scientist and former Director, ITRC, Lucknow, as Chief Guest, and Dr M.S. Chorghade, Cytomed, USA, as Expert Consultant/Course Director.

Welcoming the guests and delegates, Dr P.K. Seth, Director, ITRC, spoke about CSIR plans for GLP implementation, and associated modernization of infrastructure, human resources development through training and retraining, and the objective of global accreditation and acceptability of technologies, data and reports generated within CSIR system, through GLP implementation. He drove pertinence of GLP from lab to environment, industries to consumers and clinical/field situations, where valid documentation is the only way for today's acceptability in international forum.

The technical sessions, conducted by Dr M.S. Chorghade, on 1 and 2 September comprised General lab organization, Mission statement, Quality goals, Personnel training, Quality assurance, Comparisons of cGLP/cGMP with ISO-9000, and Total quality management with reference to pharmacology/toxicology studies, Log books, Validation of process, methods and instruments, ICM guidelines, Lab certification, Audit and FDA questionaire.

On the final day of the second GLP course, the forenoon session was allocated to discussion, problem solving, and evaluation of some SOPs, study plans, etc., prepared by individual labs towards GLP implementation. Dr Chorghade evaluated each such material and suggested areas of further improvements wherever applicable.

The certificates were distributed to the participants by Dr R.C. Srimal. ❑

CSIR observes Hindi Fortnight

THE Council of Scientific & Industrial Research (CSIR) Headquarters at New Delhi observed Hindi-fortnight during 12-26 September 1997. It was inaugurated by Shri Chandradhar Tripathi, ex-Secretary, Government of India.

During this fortnight, several competitions in Hindi, such as noting / drafting / typing / stenography / poem recitation/essay writing/terminology/conversation and debate were organized. Around one hundred participants from CSIR took part in these competitions. Of these, 68 officers/employees were awarded for their excellent performance, and 16 others, for working exclusively in Hindi.

In addition to these, national-level prizes were also given under the various CSIR schemes, e.g. 'Hindi main Maullick Vigyan [Pustak] Leikhan Puruskar Yojna', 'Vaigyanik Karyo main Hindi Puruskar Yojna' and 'Vigyan Chinta Lekhmala'.

Shri T.P. Pathak, Scientist, NISCOM, New Delhi, got the first prize (Rs 20,000) for his book *Aisa Kyon Hota Hai* under the 'Maullik Vigyan [Pustak] Leikhan Puruskar Yojna'. Shri Vasudev Prasad of CSIO, Chandigarh, got the second prize for his book *Paryavaran Pradushan — Bachav va Niyantran.* Two awards, each of Rs 10,000, were given to Dr Gopal Misra and five other scientists of NBRI for their book *Pan ki Unnat Khaiti:* and Dr Surendra Kumar Chaudhary of RRL, Jammu, for his book *Arthic Unnati va Rojgar haitu Resham Udyog,* as consolation prizes.

Two institutes, namely, National Institute of Oceanography, Goa, and Indian Institute of Petroleum, Dehra Dun, received shields as First and Second prizes respectively, for their performance under 'Vaigyanik Karyon main Hindi Puruskar Yojna'. Under the same scheme, Dr Saida Wafar and Dr Anil Aarga Chandershekhar of NIO, Goa, and R. Ranjan Banerjee and Dr Bhagwan Shanker Deekshit of NBRI, Lucknow, received cash awards. In addition to this, ten scientists were awarded under the scheme 'Vigyan Chinta Leikhmala'.

The prizes were given away by Dr R.A. Mashelkar, Director General, CSIR. ❑

TRAINING PROGRAMMES

UNICEF-sponsored Training of Hospital Technicians by CSIO

UNICEF has identified the Central Scientific Instruments Organisation's (CSIO's) Service & Maintenance (S&M) Centres at Jaipur and Delhi for training of hospital technicians on Basic Health Equipment. As a follow up, the S&M Centre at Jaipur, in collaboration with Commissioner of Health Services, Gujarat, organized a training programme on Maintenance of Basic Health Equipment at Gandhinagar, Gujarat, in the recent past. This was the third in the chain of training programmes conducted by CSIO with sponsorship from UNICEF.

Dr Shukla, Joint Director, Health Services, Government of Gujarat, while inaugurating the programme advised the participants to derive maximum advantage from the programme. Mentioning that resource personnel from CSIO have a long experience in the field of instrument maintenance, he asked the participants to make full use of the opportunity provided to them through this training programme.

Speaking on the occasion, Shri G.R. Baru, Project Officer, UNICEF, Jaipur, informed the audience that the training programmes organized by CSIO on equipment maintenance have contributed substantially in reducing the down time. He expressed the hope that this training programme too would lead to a drastic reduction in down time of health equipment.

Shri S. Sivagaminathan, Scientist-in-Charge, S&M Centre, CSIO, Jaipur, and one of the Co-ordinators of the programme, explained the basic philosophy of these training programmes which laid emphasis both on theory and practicals to disseminate as much knowledge about the equipment as possible. He was confident that such programmes would certainly improve the skill and add to the knowledge of the participants.

The training programme had six sessions which covered the following instruments: Neo-Natal Resuscitation Kit, B.P. Instruments, Suction Machines, Autoclaves & Weighing Machines, Centrifuges and Microscopes.

The lecture sessions covered basic principles of operation, description of various systems and subsystems, preventive maintenance, trouble shooting, repair techniques, tools required to carry out repairs, etc. The practical sessions dealt with disassembly and assembling of instruments, fault detection, replacement of defective components, adjustments, testing and calibration of instruments. Practical sessions also included the demonstration of maintenance procedures.

Twenty participants from various primary health centres and hospitals of Gujarat participated in this training programme. Faculty consisted of scientists from CSIO's S&M Centres at Chandigarh, Delhi and Jaipur.

Besides Shri S. Sivagaminathan, Shri P.C. Thakur, Cold Chain Officer, Commissionerate of Health Services, Gujarat, was the other coordinator for the programme.

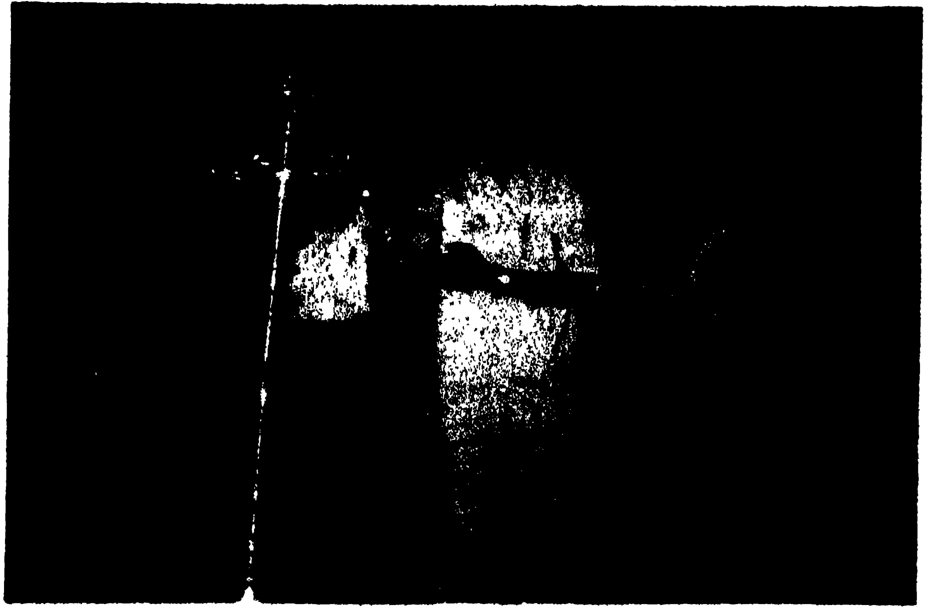
UNICEF has asked CSIO to prepare Basic Health Equipment Maintenance Manuals for use by hospital technicians, under a separate consultancy arrangement. ❑

Short Course on Analysis of Oils & Fats

A short course on Analysis of Oils and Fats was conducted during 8-12 September 1997 at Indian Institute of Chemical Technology (IICT), Hyderabad. It was organized by the Oil Technologists' Association of India (OTAI), Southern Zone (SZ), and Oils & Fats Division of the institute. Twenty quality control personnel from industries and R&D institutions such as National Dairy Development Board, Anand; Navcom Industries Limited, Sangli; Godrej Foods Limited, Mumbai; General Foods Limited, Indore; Chemical Engineering Department, Visakhapatnam; JOCIL Limited, Guntur; ITC Agro Tech. Limited, Kurnool and Rajasthan; University Department of Chemical Technology, Mumbai; Malaprabha Cooperative Oil Mills Limited, Karnataka; Sree Rayalaseema Alkalies and Allied Chemicals, Kurnool; Analab, Khammam; The Andhra Sugars Limited, Guntur; and three participants from Nagarjuna Agro Tech., National Institute of Nutrition and M/s Shalimar Agro Tech. Pvt. Limited, Hyderabad, attended the course.

The course objective was to provide latest knowledge and experience in analysis of oils and fats by instrumental techniques. The course faculty consisted of Dr V.V.S. Mani and Dr V. Krishnan from Hindustan Lever Research Centre, Mumbai and Dr T.N.B. Kaimal, Head, Oils & Fats Division, IICT; Dr Sajid Husain, Head, Analytical Division, IICT; Shri H.L. Upendra from Bureau of Indian Standards; Dr S. Babu from National Institute of Nutrition; Dr A. Madhavan from Directorate of Vanaspati, Chennai and Dr A.B. Afzalpurkar, Dr H. Sumathi Vedanayagam, Dr R.B.N. Prasad, Dr B.V.S.K.Rao, Dr A.S.R.Krishnamurti, Dr Kifayatullah, Dr P.N.Sarma and Dr P.J. Reddy, Scientists, IICT.

The course was inaugurated by Dr Kamala Krishnaswamy, Director, National Institute of Nutrition, Hyderabad and Dr K.V. Raghavan, Director, IICT, presided over the function. The conveners of the programme were: Dr H. Sumathi Vedanayagam, Scientist (IICT) and Shri T.C. Rao, Honorary Secretary of OTAI (SZ). ❑


Dr K.V. Raghavan, Director, IICT, is lighting the lamp during the inauguration of short course on 'Analysis of Oils & Fats'. Dr (Smt) Kamla Krishnaswamy, Director, NIN (*extreme left*) inaugurated the course.

NEW PUBLICATIONS

Handbook on Crude Oil

A unique reference book for crude oil evaluation, containing data on Indian and foreign crude oils being processed in Indian refineries, has been brought out by the Indian Institute of Petroleum (IIP), Dehra Dun.

This two-volume handbook presents a comprehensive view of Indian crudes and some imported crudes, their processing aspects and useful data in a handy way. Producers, refiners, designers and planning agencies in the oil sector would find the book very useful.

Shri Y. Kumar, a senior Deputy Director, has completed these volumes under the guidance of Dr T.S.R. Prasada Rao, Director of IIP. Shri Kumar is Group Leader of the Technology Information and Forecasting Group (TIFAG) at the institute.

IIP has been regularly carrying out evaluation of crude oils since the early sixties when the institute was established. The two-volume publication contains data from published literature besides that generated in the institute which has a computerized database. The handbook is the first of its kind and has been welcomed by the petroleum industry.

Quick evaluation of practically all samples and detailed evaluation of selected crudes are carried out at IIP to meet various processing and design needs of the refining industry. Efforts have been made to present the data in as uniform a format as possible. The available data were scrutinized and useful ones selected in the context of the current refining scenario.

The first volume provides detailed evaluation of data on twenty-nine Indian crudes and several imported crudes. All main fields in Bombay High, Gujarat and Assam regions have been covered. For each crude oil, an executive summary is given to highlight its nature, TBP yields and quality of straight run products.

The second volume contains short assays of crude oils being processed or likely to be processed in India. Its first section covers short assays on 49 foreign crudes of interest to the Indian refining industry. These are mainly the crudes from Saudi Arabia, Iraq, Iran, Kuwait and UAE.

The handbook will help the petroleum industry in the selection and processing of crudes, design of grassroot refineries, trading of crude oils and their transport problems and in determining the suitability of feed stocks for secondary processing. ❑

NBRI celebrates Birth Anniversary of the Father of Library Science Dr S.R. Ranganathan

THE National Botanical Research Institute (NBRI), Lucknow, celebrated the 106th birthday of Dr S.R. Ranganathan, who is regarded as 'Father of Library Science', on 12 August 1997. On this occasion, Dr N.R. Satyanarayan, Head of Department of Library and Information Science, Lucknow University, was the Chief Guest. He spoke on Dr Ranganathan's Five Laws of Library Science, and his contributions to the profession. Presiding over the function Dr R. Tuli, Deputy Director, NBRI, emphasized the need for computerization in libraries.

Shri H.V. Mote, Library Officer, introduced the Chief Guest to the audience. Smt. A. Akbar proposed a vote of thanks. Shri M.L. Kain conducted the function. ❑

HONOURS & AWARDS

IICT Scientists win IPA Awards

DR Syed Haseebuddin, SRF and Dr K.V.S.N. Raju, Scientist along with Dr Yaseen, Head, Organic Coatings & Polymers Division, Indian Institute of Chemical Technology (IICT), Hyderabad, have received the Indian Paints Association (IPA) Award 1996 for their paper entitled 'Crosslink density and cure window of oligourethane diol/melamine high solids coatings'.

Dr V.S. Kishanprasad, Scientist and Dr P.H. Gedam, ex-Scientist of the Organic Coatings & Polymers Division of IICT have received the IPA Award 1996 for their paper entitled 'Poly (ester amide) and poly (ester imide) resins for air-drying protective coatings'.

Shri H.N. Ranganatha

SHRI H.N. Ranganatha of the Advanced Composites Unit of the National Aerospace Laboratories, Bangalore, is the joint recipient of the ISAMPE's Vijay Zaveri Award for Best Technician 1997, for his contributions to the fabrication of wind tunnel models for aeroelastic studies. ❑

Dr Indira Rajagopal

DR Indira Rajagopal, Head, Surface Engineering Unit, National Aerospace Laboratories, Bangalore, has been jointly awarded for the Federation of Indian Chambers of Commerce and Industry (FICCI) Award 1996-97 in recognition of her individual initiatives in physical sciences.

Dr Raghu V. Prakash

THE paper titled 'Assessment of replication of optical fractographic technique to study short crack behaviour' by Dr Raghu V. Prakash, Structural Integrity Division, National Aerospace Laboratories, Bangalore (jointly with R. Sunder and E.I. Mitchenko), published in the Transactions of the Indian Institute of Metals [49(4): 517-526] during 1996, has been awarded the BINANI Gold Medal.

Dr P.K. Seth

DR P.K. Seth, Director, Industrial Toxicology Research Centre, Lucknow, has been elected Fellow of the Indian National Science Academy (INSA), New Delhi, in recognition of his outstanding research contributions. Dr Seth has made significant contributions towards understanding of the mechanisms of action of chemicals acting on the nervous system, demonstrating the presence and role of cytochrome P-450 and glutathione-5- transferase system in metabolism of xenobiotic in brain and establishing usefulness of blood platelets as perepheral model for understanding the action of chemicals acting on nervous system and certain disease conditions.

He is a Fellow of Collequim Internationalle, Neuropsychopharmacologie, National Academy of Sciences, Allahabad, Indian Academy of Neurosciences and Society of Toxicology and member of several national and international scientific bodies. ☐

ANNOUNCEMENTS

Schedule of Activities at RRL - Thiruvananthapuram

SCHEDULE of activities at the Regional Research Laboratory (RRL), Thiruvananthapuram, during November 1997 - February 1998 is as follows:

- International Conference on Frontiers in Biotechnology (26 - 29 November 1997)
- Training of Farmers in TBIC [Second Batch] (Ist week of December 1997)
- National Workshop on Catalysis (11-13 December 1997)
- National Conference on Electron Microscopy (17-19 December 1997)
- Training on Home scale Processing of Coconut for Women Entrepreneurs [Second batch] (4th week of December 1997)
- International Symposium on Photochemistry (7-9 January 1998)
- Distribution of Pesticides Kits for BHC [First batch] (3rd week of January 1998)
- Follow-up on Programme on Feeding of Edible Red Palm Oil to 2000 Balwadi Children of Vivekanand Kendra, Kanyakumari (4th week of January 1998)
- Training on Home-scale Processing of Coconut for Women Entrepreneurs [Third batch] (Ist week of February 1998)
- Training of Farmers in TBIC [Second batch] (2nd week of February 1998)
- National Science Day Celebrations (28 February 1998). ☐

NAL-UNI LECTURE SERIES

Software Engineering for Mission/Safety Critical Systems

SOFTWARE engineering has evolved from the art of hand-crafting a programme to the era of manufacturing a software product. There is an increasing emphasis on product quality, process maturity and continual improvement. Proven standard technical methods like analysis, design, etc., provide the basis for building software products.

Safe and reliable software is mandatory for safety-critical systems. Market delays and operational failures dominate the design of mission-critical software. Low profit and high cost of customer support dictate the quality factors of commercial software. Adopting some standard development methods that have quality assurance techniques such as reliability/safety analysis and verification/validation combined with testing provide support for achieving quality products.

The title course is being organized at National Aerospace Laboratories, Kodihalli Campus, Bangalore, during 17-19 December 1997, to give an overall view of software engineering with special emphasis on quality assurance aspects.

It will cover the following topics:

Software engineering principles (Five lectures covering Architecture, Analysis techniques and Design fundamentals).

Quality assurance (Nine lectures covering Testing verification/validation, Reliability and Safety).

Software project management (Three lectures covering Metrics, Planning and Control)

Tools/CASE tools (One lecture on general overview and a Vendor's presentation).

Software engineers and students with B.E./M.E. are eligible for the course. Background in 'data structures' and/or competence in one or more programming languages is a prerequisite. Faculty consists of A. Pedar, Scientist, NAL, and V.V.S. Sarma, Professor, IISc.

Course fee is Rs 3000, and 35 persons will be accommodated in this course. For further details please contact: Dr G. Prathap, Convener, NAL-UNI Programme or Shri M.R. Narasimha Swamy, Head, Technical Secretariat, National Aerospace Laboratories, Post Bag N01779, Bangalore 560017. Tel: 080-5273351, 5271112, Fax: 080-5260862, Telex: 0845-2279 NALIN. ☐

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit

Annual Subscription : Rs. 60
Editors : Dr B.C. Kashyap and Dr C.S. Gupta Editorial Assistant : Neelima Handoo Production : Kaushal Kishore Single Copy : Rs. 3.00
Phone : 5786301 Gram : PUBLIFORM Telex : 031-77271 E-mail: niscom@sirnetd.ernet.in. Fax : 5787062
RN-4512/57

ISSN 0409-7467

CSIR NEWS

TRendys in Biochemistry - 1997

THE fourth meeting on 'TRendys in Biochemistry' was held during 15-16 September 1997, at the Indian Institute of Chemical Biology (IICB), Calcutta. It provided a unique opportunity to the participants to present a concept, an innovative or break away idea. The meeting had three sessions in which a total of 14 talks were presented. The meeting was convened by Dr J. Das and Dr P.K. Sarkar and attended by about 60 scholars and scientists from all over the country.

Dr J. Das, Director, IICB, welcomed the distinguished gathering. Prof. K. Subba Rao of the University of Hyderabad, narrated the genesis and the philosophy of the TRendys meetings. Prof. T. Ramasarma of the Indian Institute of Science, Bangalore, delivered a brief talk on some conceptual connections between Biochemistry and Genetics.

The first session was on '*Human Genetics : Genetic Disorders and Genome Diversity*'. Prof. Partha P. Majumder of Indian Statistical Institute, Calcutta, described the conceptual paradigm underlying the human genome diversity. The possible applied spin-offs from these studies were also discussed. Prof. Rajiv Raman of Banaras Hindu University, Varanasi, spoke about pathologies owing to various abnormalities in the Y-chromosome. Starting with a model example of a genetic disorder which has been recently mapped, Dr B.K. Thelma of Delhi University, South Campus, discussed the requirements for the conduct of human genetic studies in India. Genetic diseases that occur owing to expansion of trinucleotides repeat in human genome; and current status of our knowledge on the genetics and pathology of common neurological disorders, was described by Prof. K. Subba Rao of the University of Hyderabad and Dr Pranab K. Sarkar of IICB, respectively.

The second session was on '*Evolution of Genes and Genomes*'. The analyses of DNA sequence data from various organisms have become very popular with the accelerated release of these data in the public domain. Such analyses are extremely useful for comparative gene mapping and for identifying functions of unknown genes. Patterns of codon usage in relation to translational and mutational bias of the organisms were described by Dr Chitra Dutta of IICB and Dr Tapas K. Ghosh of Bose Institute, Calcutta. Dr Asesh Nandi of IICB provided a geometrical and graphical method to summarize sequence data, and discussed some evolutionary trends. Prof. D.P. Burma and Dr Prabal Chowdhury of Indian Statistical Institute, Calcutta, discussed some summary statistics of DNA sequences that may be useful in reconstructing evolutionary phylogenies.

'*Biology of Cancer and Infectious Diseases*' was the theme of the third session. Dr Susanta Roychoudhury of IICB and Dr Chinmoy Panda of National Cancer Research Centre, Calcutta, described some current models of carcinogenesis that appeared to explain observed genomic instability and the stepwise appearance of mutations in cancer. The molecular genetics and the regulation of multiple virulence

Seen on the dais during 'TRendys in Biochemistry' (from left) are: Prof.K. Subba Rao, Prof.T. Ramasarma, Dr J. Das, Prof. P. Mazumder and Dr P.K. Sarkar

determinant factors of infectious diseases caused by *Leishmania* and *Mycobacterium* were discussed by Dr Samit Adhya of IICB and Dr Nitai C. Mandal of Bose Institute. Both the speakers discussed the complex nature of genetic interactions involved in the process of infection, while examining the molecular basis of pathogenicity.

Dr Jyotirmoy Das, spoke on the '*Inappropriateness of the Concept of Genetic Determinism*'. He stated that the Watson-Crick era which began as a narrowly defined paradigm of gene has mistakenly evolved as the paradigm of life and a thoroughly molecular form of genetic determinism. In promising to review the secrets of life, it has extended itself to a level of complexity where as a paradigm, it has little power and must eventually fail. Mentioning the Kuhnian revolution in Physics, Dr Das suggested that there is a strong need for a unified paradigm which can correlate function and form.

Most of the lectures presented in this meeting provoked high-level scientific discussions. The participants critically interacted with the speakers and freely expressed their views and comments on the concepts presented by the speakers. ☐

National Seminar on Free Flight

A National Seminar on Free Flight was held at the National Aerospace Laboratories (NAL), Bangalore, on 22 November 1997. The Seminar was organized by the Bangalore Branch of the Aeronautical Society of India.

Prof. U.R. Rao, Vikram Sarabhai Distinguished Professor, ISRO, as he began his inaugural address joked, "Free flight does not mean free tickets on *Indian Airlines* or *Air India* flights". "Free flight" essentially refers to the freedom available to an aircraft pilot to choose his flight path (the conventional approach requires all airplanes to fly through well-defined flying corridors under the overall supervision of air traffic control agencies). "It is a novel and exciting concept which has become possible because of new enabling technologies such as global positioning systems (GPS), data links and advances in cockpit displays", Dr S. Nagabhushana, Head, Aerospace Electronics and Systems Division and Seminar Convener, explained in his introductory brief.

The seminar opened with a brief welcome address by Lt Gen. Dr V.J. Sundaram, Director, DRDL, and President, Aeronautical Society of India. This was followed by Prof. Rao's address which was notable for its flashes of humour interspersed with a serious commentary on the emerging technological trends in aerospace. "When GPS first came on the scene, there were many who wondered if the technology would be really useful. But today it is a hot selling communication product with a market of two billion dollars, and a projection of eight billion dollars by the year 2005", he said.

Prof. Rao then explained how applications are changing. "We grew up with the belief that fixed satellite systems were for broadcasting, but today mobile communication has become the principal driver", he observed. Prof. Rao also mentioned the remarkable opportunities offered by the combination of GPS with geographical information systems (GIS). "The GPS-GIS combination promises prediction accuracies which were unheard of", he pointed out, citing how farmers in North America use GIS+GPS to selectively spray pesticides on their large and sprawling farms. Prof. Rao ended by saying that free flight concepts may not entirely please Indian Air Traffic Controllers

(ATCs), "but, as you are well aware, whenever there's a traffic cop, there's a traffic jam!".

Indeed, the greatest impact of free flight will be the changed role of pilots and ATCs. Free flight would require greater decision-making on part of the pilot (although it may not increase the pilot's overhead), while ATCs would function more like 'managers', instead of 'operators'.

These issues were put in a proper perspective by Dr William R. Fromme of ARINC, USA, in the course of his keynote address. "We need free flight (which could also be described as 'autonomy of flight') in future air navigation systems essentially to overcome three limitations. "First, because existing systems are essentially based on line-of-sight concepts — and are therefore of short range; second, because it is impossible or impracticable to cover all possible airspace; and third because communication in today's systems is still largely restricted to the voice-only mode". Dr Fromme could hardly contain his excitement at the opportunities offered by free flight systems. "The free flight-based Future Air Navigation Systems — FANS, endorsed by ICAO in 1991, will be the largest aviation infrastructure programme ever undertaken", he observed.

The inaugural session ended with a vote of thanks by Air Marshal P. Rajkumar.

The tea break that followed offered one the opportunity to greet Shri Alka Sen, now 78, the genial and kindly Editor (now Adviser) of *Indian Aviation*, and Air Marshal M.S.D. Wollen, the former HAL Chairman. Shri Sen is now giving the finishing touches to his much-awaited *Glimpses of Indian Aviation*, which surveys the Indian aviation scene as he saw it evolving over half a century. And Air Marshal Wollen uttered the last word on free flight: "the real issue is of separation distances between aircraft. With free flight systems, planes can get much, much closer and that, as you know, means much, much more money!". ❑

NATIONAL PHYSICAL LABORATORY, NEW DELHI
R&D Highlights

THE R&D programmes of the National Physical Laboratory (NPL), New Delhi, relate to: Physico Mechanical Standards; Electrical Standards; Materials Development; Materials Characterization; Low Temperature Physics; and Radio & Atmospheric Sciences. The laboratory took up twenty-five new sponsored/supported projects, continued, investigations on 51 projects and completed 14 projects during 1995-96. The laboratory maintained scientific collaboration and liaison with other scientific institutions—26 in India and 17 overseas. Several projects were undertaken during the year under sponsorship from DST, DRDO, DBT, NRDC and DoE, etc. The major technological accomplishments of the laboratory during the year include:

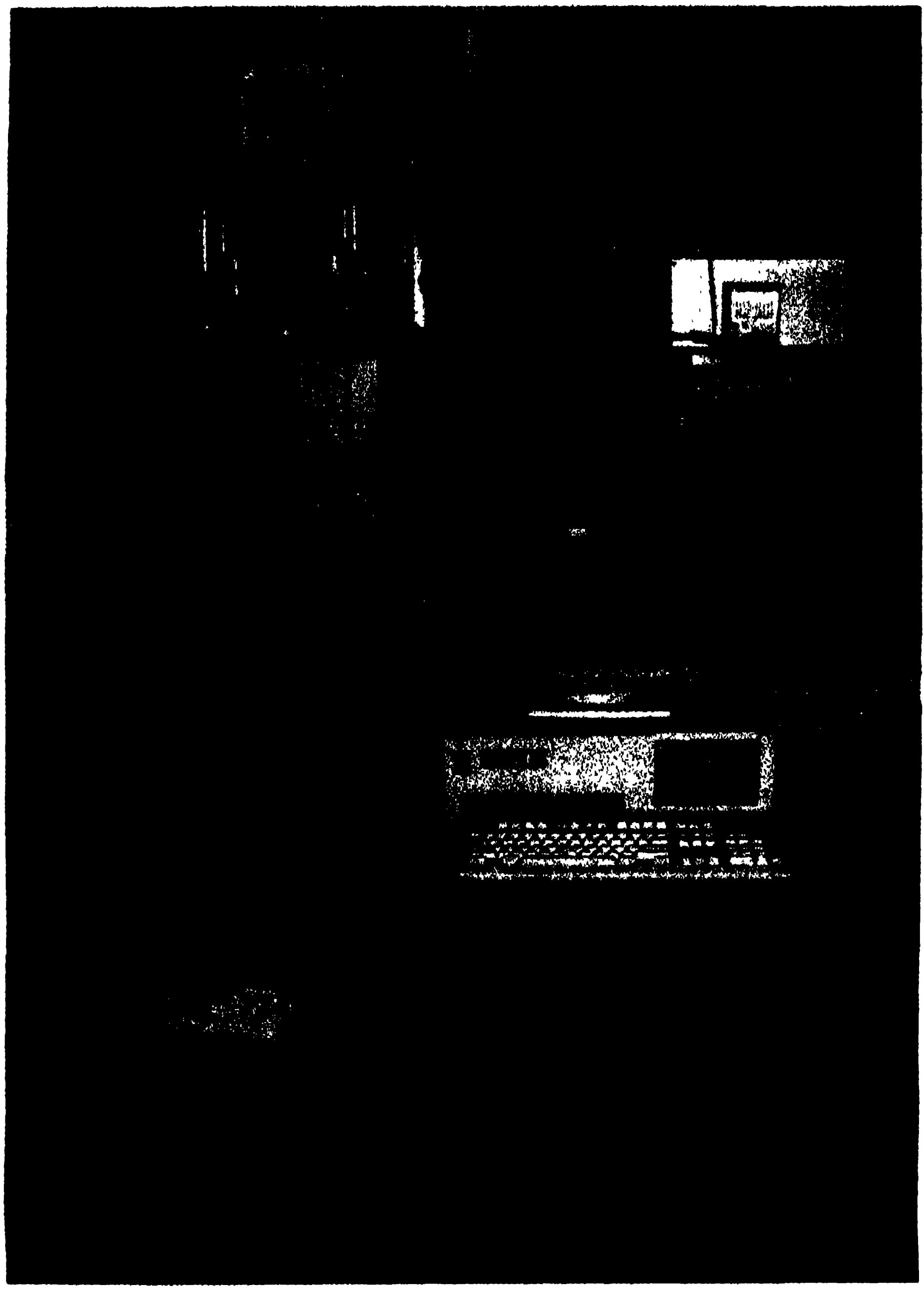
Physico Mechanical Standards

Length Standards: The primary Length Standard is being maintained in the form of an iodine stabilized He-Ne laser at 633 nm. A software has been developed and installed for beat frequency data acquisition and processing. An iodine stabilized He-Ne laser after its calibration at VNIIM, Russia and PTB, Germany, has been received from PTB and installed at NPL.

Laser interferometers and secondary standard lasers for precision measurements from several industries were calibrated and certificates issued. Commercially viable Zeeman stabilized secondary standard He-Ne laser was developed and fabricated.

A consultancy project on Reconditioning of He-Ne lasers and installation of Ar ion lasers in the laser-based systems at Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram, has been successfully completed. A project proposal on 'Development of laser Doppler velocity meter for non-contact length measurements of moving samples' has been submitted to DoE for approval.

The additions/upgradation of facilities for Dimensional Metrology include: Installation of surface roughness measurement facility; Augmentation of angle measurement facility; Improvement in the measurement uncertainty of NPL standard slip gauges from 0.04 µm to 0.015 µm for gauges up to 10 mm, and 0.1 µm to 0.05 µm for gauges up to 100 mm length through their calibration at PTB Germany.



Automatic computer-based solid density standard system

Mass: National Standards of mass, volume, density and viscosity are being maintained and calibration services for weights, balances, hydrometers, volumetric measures and viscometers offered.

Force: 6 MN Hydraulic Multiplication system has been erected and electrical work for its operation is in progress. Torque generation facility has been extended from 1500 N.m to 2000 N.m.

Pressure & Vacuum: Activities related to Pressure Standards included: In-hosue calibration of three different secondary standards up to 12 MPa by cross-floating with different working fluids, viz. nitrogen, argon, helium and hydrogen; Ultra high pressure generation up to 40 GPa using diamond anvil cell (DST project); Dielectric properties of ceramic relaxor of materials under high hydrostatic pressure to investigate the feasibility of developing capacitance transducer for the measurement of hydrostatic pressure (INDO-US project); and Design and development of commercial hydrostatic piston gauge pressure standards up to 60 MPa with improved measurement uncertainty up to ± 0.03%.

In the area of Vacuum Leak Standards, a method has been developed in which a calibrated leak is used to calibrate a spinning rotor gauge or a capacitance diaphragm gauge. The attractive feature of this technique is that it can be used to calibrate those gauges which may have some discontinuity and for the precise existence and location of which the pressure would need to be recorded continuously.

The various temperature standards were continued to be maintained and calibration services offered.

Optical Radiation: A detector, spectral response calibration facility, using a monochromator based spectral comparator (350 nm to 1100 nm) has been established. Also, the development work on the standards of spectral specular reflectance, and spectral transmittance for 2.5 to 25 µm region has been taken up.

The facilities for: The calibration and measurement of UV radiation sources; UV detectors response and linearity; Characterization of UV filters for transmittance and spectral bandwidth; Calibration of portable UV meter, etc. have been created and extended to industries and user institutions.

Acoustics: Industrial noise surveys were carried out in two factories. Calibration/testing of a large number of electro-acoustic equipment was also carried out.

Ultrasonics: Units of 38 kHz underwater pinger device, complete with electronics and battery, were supplied to NSTL, Visakhapatnam.

Various hydrophones fabricated using 1-3 composite ceramic elements, supplied by NMRL, Bombay, have been tested in underwater acoustic test tank to evaluate their receiving sensitivity and directional characteristics.

A transponding acoustic system has been fabricated using a 75 kHz tuned acoustic receiver as trigger in combination with an acoustic pulse transmitter, having response sensitivity of about 154 dB re: 1µ Pa.

A method has been developed for the measurement of ultrasonic attenuation in solids in form of rod, which is free from sources of error such as diffraction, reflection and transmission losses. A method for the measurement of ultrasonic attenuation at different frequencies in parallel plates has also been developed, facilitating the on-line diffraction correction. A method has also been developed for the accurate measurement of ultrasonic longitudinal and transverse velocity in solids using single ultrasonic transducer.

Electrical Standards

Time & Frequency: Considerable breakthrough was made in STFS, both in terms of improving the time transfer accuracy and in drastically reducing the cost of the receiving set-up. Using compensation technique, the time transfer accuracy was reduced from ± 10 µs to ± 1 µs. The receiving set-up was redesigned in collaboration with ER&DC, Thiruvananthapuram, to bring down its cost from a prohibitive Rs 0.25 million to Rs 50,000.

The effect of degradation of time transfer through GPS satellites has been reduced using an algorithm developed for the purpose.

Josephson Voltage Standard: Investigations under the Indo-French project on 'High-Tc thin films' resulted in the development of high quality YBCO thin films with $T_c \sim 89\text{-}91$ K and $J_c = 2\times10^6$ A/cm^2 at 77 K.

Several BSCCO RF-squids were fabricated and suitable encapsulation techniques developed to stop degradation in characteristics of squids with time and thermal cycles/moisture. One BSCCO RF-squid probe was supplied to CEERI, Pilani, for day-to-day testing of the electronics being developed there.

Microwave superconductivity: A modified and plate replacement technique has been developed for measurement of microwave surface resistance of HTS samples of small dimensions.

A YBCO thin film microstrip resonator has been designed and fabricated. Various characteristics of the resonator, such as quality factor, insertion loss and frequency shift as a function of temperature and input incident power, have been measured.

LF & HF Impedance Standards: A 10 pF reference standard capacitor of parallel plate configuration has been designed, fabricated and assembled. Its stability has been studied for a period of more than one year and as such it is found to be stable within 20 ppm per year. It is now ready for hermetically sealing.

Work was continued on the maintenance and updating of the primary and transfer standards of AC and LF voltage and current, HF and MW power and noise in the frequency range of 10 Hz to 26 GHz and providing apex level calibration facilities for the above parameters to user organizations all over India.

International intercomparison of multi junction thermal converters (primary standard of LF voltage) has been carried out under BIPM umbrella with 11 laboratories under Euronet loop and 11 laboratories in world wide loop. Three volt MJTC was intercompared at 1 kHz, 20 kHz, 100 kHz and 1 MHz. The intercomparison was carried out on a fully automated set-up which was designed at NPL. The relative AC-DC transfer error of NPL MJTC with respect to PTB MJTC is within ± 5 ppm up to 100 kHz and ± 20 ppm at 1 MHz, showing an excellent agreement in NPL and PTB LF voltage standards. One voltage calibration tee has been fabricated based on PTB design for voltage calibration work in the 10 MHz to 1000 MHz frequency range.

HF & Microwave Attenuation and Impedance Standards: Calibration facilities were upgraded for coaxial fixed and variable attenuators in the frequency range 1-18 GHz in coaxial and waveguide systems using AF and IF substitution techniques.

Magnetic Standards: Facilities have been established for the calibration of fluxmeters using volt-second generator with an overall uncertainty better than ± 0.5%.

Search coils of different turn-areas used for the measurement of flux have been designed and fabricated. A multi-layered one metre long standard solenoid has been designed and fabricated.

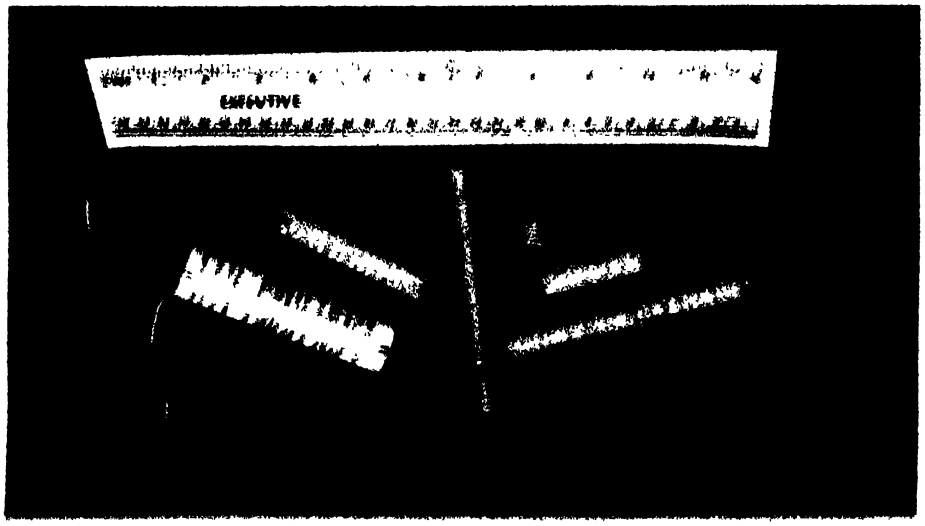
The AC measurement set-up for soft magnetic materials is ready for testing and calibration and the NMR measuring set-up ready for evaluation.

Materials Development

Silicon and Silicon Devices: A novel method of bringing about a substantial improvement in the I-V characteristics of solar cells showing high series resistance has been developed. In this method, the cells are treated wth NaOH and AgNO$_3$ solutions, reducing the series resistance and increasing the curve factor of the cells without any noticeable adverse effect on the contacts. The PECVD system, Vacutec model 1530S, was made functional by making it PC controlled, and a number of cells were given Si$_3$N$_4$ AR coating using this system. The cells were found to have open circuit voltage (V_{oc}) ~ 585-595 mV, the short circuit current density Jsc ~ 27-30 mA/cm^2, curve factor ~0.68-0.73 and efficiency ~ 11-13%.

Techniques to fabricate long length silver clad monofilamentary BPSCCO tapes by the PIT method have been refined to produce tapes and spiral coils. Thickness was reduced first in form of wire and then the resultant wire was rolled in tape form in several reduction steps with intermittent annealing after each step. Five metre long tapes single filamentary and 10 cm long multifilamentary (6-9 filaments) tapes have been fabricated and end-to-end superconductivity at 77 K demonstrated. The tapes showed critical current density (J_c) of ~ 3000 A/cm^2 at 77 K and OT. Small superconducting coils made out of these tapes showed a J_c of 1000 A/Cm^2 at 77 K in self field.

Magnetic Materials: A project to increase the silicon content of silicon steel sheet to 6 wt% Si by CVD process and optimize its magnetic properties was taken up under the sponsorship of TISCO. A CVD reactor to deposit silicon from SiCl$_4$ on low silicon steel was built with diffusion anneal facility up to 1300°C. Starting from steel with 1.5 wt% Si, feasibility of increasing the silicon content to 6.5 wt% Si was established. The operational data on silicon deposition rate and its variation with substrate temperature, time, gas flow rate and SiCl$_4$ content of the gas were generated. Parameters for homogenization anneal were also optimized. The high silicon steel showed the following properties: Si (6.0-7.5 wt%), B_s (1.5-1.8 T), H_c (2-4 AT/m) and electrical resistivity (90-100 µΩ-cm).



Some of the superconducting coils of different lengths (up to 5 m) of silver clad HTSC BPSCCO tapes

Studies on a DST-funded project to fabricate an Automatic Self Locking NMR Gaussmeter were taken up.

In the area of interface and microstructure devices, considerable progress has been achieved on the post deposition processing involving annealing, CdCl$_2$ treatment, surface conditioning and formation of pseudo-ohmic contacts. As part of the industrial consultancy for EcoSolar Systems, Pune, the process technology for the preparation of contacts has been provided.

The design, fabrication and testing of an ion beam micro etching system for the fabrication of samples for structure analysis in electron microscopy has been undertaken for DST. The ion source has been designed, developed and employed to generate ion beams of energies up to 6 keV for using the same in micro etching. A complete system with multiple ion beam guns and sample manipulator assembly has been designed and integrated for supply to user organizations.

Phosphor screens for scintillation counters have been made for BARC and feasibility trials for photostimulable phosphor screens conducted.

Biomolecules, Electronics and Conducting Polymers: The 'Glucose biosensors' developed at NPL for monitoring sugar levels in blood are now being manufactured by Pulsatum Health Care Pvt. Ltd, Bangalore. The company has relesed a commercial model for extensive clinical trials and user reactions.

Novel solid polymeric electrolytes based on polyvinyl butyral have been developed using different lithium salts and appropriate solvents. High ionic conductivity has been acheived making them suitable for usage in electrochromic devices for 'Smart window' applications.

Achievements made in the area of conducting polymeric filters for virus monitoring in water related to the development of polypyrrole-based conducting membranes by optimizing surface resistance.

Polymeric thin film based gas sensors have been developed for monitoring of toxic and effluent gases from the semiconductor, coal mines and other industries. These gas sensors have been tested for their sensitivity towards NH_3, HCl, CO, CO_2 and HCN. Polymer based microbiological sensors have been prepared and their sensitivity towards biological species, virus and bacteria studied.

Activities pertaining to 'Carbon products' included: Providing consultancy to M/s Machining Centre, Bombay, for putting up a 5 TPA capacity carbon fibre plant; Providing consultancy to put up an activated carbon fibre cloth pilot plant at HEG, Bhopal; Studying the stabilization of PAN fibres under fludized bed; and Developing carbon fibre, kevlar fibre, and polyethylene fibre based composites using various matrics such as PPEK, PS and HDPE under sponsored project from Defence.

Studies on 'Thin film systems' related to: IRDE large area DLC reactor (Process stabilized, demonstrated and plant transferred to IRDE, Dehra Dun); Multizone semiconductor processing system (Plant fabricated and transferred to CEERI after trial runs); Load locked PECVD reactor of the Department of Electronic Science, Kurukshetra University (Plant fabricated); Designs of several types of multilayer optical coatings like broadband antireflection coatings and anti-glare coatings (for OLF, Dehra Dun), and narrow-band IR filters (DST project).

Work was initiated on the extrusion of light weight/high strength metal matrix composites (MMCs) of Al-Li alloys reinforced with SiCp. This work was done in collaboration with Fraunhofer Institute, Germany. The main advantage of using Al-Li alloys is that the addition of Li increases the elastic modulus and decreases the density, making this material suitable for aerospace applications. Preliminary extrusion trials of (Al-Li+SiCp) MMC, using billets obtained from powder metallurgy route, were carried out at different temperatures, extrusion ratios and strain rates.

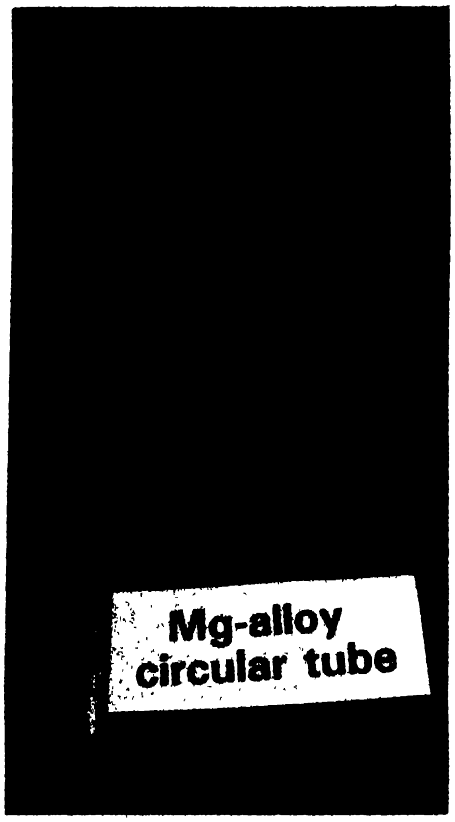
Exploratory work has been done on the development of 'Magnesium alloy square tubes' to be supplied to Vikram Sarabhai Space Centre, Thiruvananthapuram, for their space programme. Various extrusion parameters were optimized to obtain the circular tubes with good surface finish and concentricity. Work is underway for the design/fabrication of tooling such as die, mandrel, pressing discs, etc., to extrude square tubes of this light weight material.

Under a sponsored project on 'Spray deposition and property evaluation of aluminium matrix composites' of the Aeronautical Research and Development Board, work would be carried out on the synthesis of metal matrix composites using spray atomization and deposition process.

The project on 'Development of warm forging/hot extrusion of metal matrix composites', sponsored by AR&DB, has been sucessfully completed. Under this project, various process parameters were optimized for 2124 Al+SiCp (10,15 & 20%) MMC in the form of extruded rods to obtain acceptable properties and good surface finish of the extruded product.

Materials Characterization

Work on preparation of 'Certified Reference Materials (Indian Reference Materials) of Fluoride and Nickel' in high purity water has been completed. The stock solutions of these materials were prepared at NPL. The certified values



Magnesium alloy circular tube for space applications assigned to these materials are: (i) Fluoride solution – 1.00 ppm with standard deviation ± 0.03 and random uncertainty 0.04; (ii) Nickel solution – 1.01 ppm with standard deviation ±0.03 and random uncertainty 0.03.

The laboratory participated in the international inter-comparison of precise chemical analysis, organized by National Association of Testing Authorities (NATA), Australia. In first phase of the programme, measurement of concentrations of total organic carbon (TOC) contents of four samples has been carried out.

The work on characterization of different kinds of materials was continued. Various techniques including chemical methods, EPR spectroscopy, FTIR spectroscopy, X-ray diffraction techniques and electron microscopy, were used for evaluating composition, purity, structure and perfection in inorganic and organo-metallic compounds.

Nearly perfect crystals of oxides such as lithium niobate and of bismuth germinate were grown successfully.

The five crystal X-ray diffractometer, designed and developed at NPL, has been extensively used for characterization of defects in bulk crystals, thin films and interfaces. Bulk crystals of GaAs and ultra thin films of silicon-germanium have been investigated. The silicon-germanium films were prepared on 100 silicon substrates with a silicon buffer of 50 nm. The thickness of the films was ~ 40 nm. The silicon crystal SiGe film interface shows strong influence of the epitaxial film. The composition of the film was determined as $Si_{82.4}Ge_{17.6}$. High resolution X-ray diffraction topography examination has confirmed these results.

Characterization of bulk crystals of GaAs and CdTe and thin films of mercury cadmium telluride have been carried out under a consultancy agreement with SSPL, Delhi.

Low Temperature Physics

Bulk single crystals of superconducting YBCO grown with different additives, e.g. barium fluoride, boron oxide and bismuth oxide, have been investigated to gain insight into the problem of combating Tc degradation due to aluminium contamination from crucible material. The crystals have been subjected to high resolution imaging of chains and planes using STM, while the changes in the conduction spectra of chains due to Al contamination have been studied by STS technique. The role of different additives has been discussed and the observed Tc variation has been attributed to the relative changes in adulteration and disordering of Cu-O chains. The results are in agreement with the role of interlayer coupling between Cu-O planes and other effects that control Tc of layered cuprates.

A project on the development of suitable hermetically sealed (two) glass receptacles for the long-term preservation of the original manuscript of the Constitution of India, has been completed in collaboration with the Getty Conservation Institute, USA.

Liquid nitrogen based cryo-surgical probe system has been designed and fabricated. The liquid nitrogen transfer system for this unit has been assembled and tested. Preliminary studies of temperature profile measurements with this unit on goat liver pieces have been carried out.

A DST-funded project on the development of special icelined refrigerators for the long-term storage of life saving vaccines has been completed. Under another DST-funded project on cryosurgical system for ENT, a prototype unit has been designed and developed. Studies on a DST project, pursued in collaboration with BHU, on development of module hydride air-conditioner have led to the development of an improved version of sequential timer for actuation of solenoid valves.

Following the success of collaborative programme with BHEL on the development of the 'Superconducting High Gradient Magnetic Separator', NPL has now provided consultancy to BHEL on the development of a 200 kVA superconducting generator.

Radio & Atmospheric Sciences

The activities in this field relate to: Global Changes, Indian Antarctic Research Programme, MST Radar, Satellite & Radio Communications.

A Data Centre on 'Global change and other atmospheric and space science research areas' is being developed as a component of the NPL's Centre on Global Change. Apart from middle atmospheric and space science data, it will be a major storehouse for data useful for the preparation and updating of the GHG inventory of the Indian region.

Consultancies rendered during 1995-96

Sl No	Nature of Consultancy	Party	Amount (Rs)
1.	Programme Development and Modelling of 21" MF	M/s Samtel Colour Ltd, Bulandshahar Road, Village Chhapraula, Ghaziabad	10,000
2.	Trouble Shooting of DC Sputtering Power Supply	M/s Samtek Systems, R-16 Inderpuri, New Delhi.	13,450
3.	Machining of Mechanical Components	M/s Cromptom Greaves Ltd, Vandana, 11 Tolstoy Marg, New Delhi	25,000
4.	Optimisation of Medical Flowmeter for Oxygen Delivery	M/s Medical Systems and Services, H-251 Ashok Vihar, Phase-I, Delhi.	8,500
5.	Modelling & Machining of 6" Adjustable Wrench	M/s Mascot India Tool and Forging Pvt. Ltd	18,500
6.	Modelling & Machining of 20" MF Support	M/s Samtel Colour Lab Ltd, Village Chhapraula Bulandshahar Road, Ghaziabad (UP)	40,000
7.	Modelling and Machining of 4 PCs of Microwave Components	M/s Crompton Greaves Ltd, Defence System Group, 27 Rani Jhansi Road, New Delhi	24,000
8.	Putting Rb Vapour Frequency Reference (RVFR) of Hewlett Packard Rb Frequency Standard to Optimum Working Condition	Sh. V.K.N. Basavanna, Manager AVDB (Test Deptt.), HAL, Post Bag Office, Hyderabad	99,800
9.	Acoustic Design of Auditorium Building	Sh. S.L. Jain, Ex-Engineer, Division No. II, Guru Teg Bahadur Medical College Hospital Project, GNCT, Shahdara, Delhi	55,000
10.	Modelling and Machining of 2 mm Microwave Components (1)2 PCs as Pirdrawing w 783 (2) 2 PCs as Pirdrawing w 689	Air Marshal Lakhmir Singh, Crompton Greaves Ltd, Vandana, 11 Tolstoy Marg, New Delhi	21,000
11.	Modelling and Machining of 14" MF Support	M/s Samtel Colour Ltd, Bulandshahar Road, Village Chhapraula, Ghaziabad (UP)	30,000
12.	(1) Upgradation/rectification of the Large Size Oedometer to make it Fully Computer controlled System (2) Upgradation of Triaxial Equipment to make it Fully Computer Controlled	Sh. Aminesh Roy, Chief Research (RFR), Material Research Station, Olof Palme Marg, Hauz Khas, New Delhi	88,650
13.	Upgradation CPCB Soar to DC Configurable Sodar	Sh. J.S. Kamyotra, I/c (AIR LAB), Central Pollution Control Board, Parivesh Bhavan, CBD cum Office Complex, East Arjun Nagar, Delhi	73,275
14.	(1) Programme Development Modelling for Technology Development of Technology for Renosing of Funnel Plunger (2) Technical Services for Machining and Renosing of used Funnel Plunger	M/s Samcor Glass Ltd, 50-51 Community Centre, New Friends Colony, New Delhi	50,000
15.	Testing of New Installations Hardware and Software	Sh. Bhagat Singh, Dy. Director National Council for Hotel Management and Catering Technology, Library Avenue, Pusa Complex, New Delhi	2,800
16.	3-D Surface Profile Measurement Programme	Samtel Colour Ltd, Ghaziabad	22,000
17.	Acoustic Treatment in Central State Public Library, Patiala	Executive Engineer, Provisional Sub-Division PWD B&R, New Delhi	35,000
18.	Characterisation of Mercury Telluride Crystals by High Resolution X-ray Diffraction	Solid State Physics Lab., Lucknow Road, New Delhi	1,50,000
19.	Development of Die Cavities for three Hangers	M/s Sterling Finance and Leasing Co., Golf Link, New Delhi	1,10,000
20.	Modelling of Electrodes for Base Magnets	M/s Escorts Employee Ancilliary Ltd, 20/4, Mathura Road, Faridabad	12,000
21.	Development of 20 MF Retainer	M/s Samtel Colour Lab., Village Chhapraula, Bulandshahar, Ghaziabad	20,000
22.	Development of Ultrasonic Probes for NDT	M/s Aeronautical Development Agency, Bangalore	75,000
23.	Development of Foam Cutting Brass Moulds and Electrodes	M/s Samta Enterprises, Madan Puri, Gurgaon	42,000

IR solar absorption spectra for the years 1992-93 and 1994-96 have been analyzed to determine integrated columns of CO_2 and CH_4 to study their seasonal dependence and their impact on global warming.

Aerosol optical depth calculated during solar eclipse of 24 October 1995 at NPL, New Delhi, shows that aerosol optical depth increases during the maximum obscuration of solar eclipse.

A PC-based gyrostabilized shipborne monostatic acoustic sounder was designed, developed and deployed onboard the ship *MS Brinknes*. The system was operated in Antarctica. This is the first time that two closely separated sodars have been operated in Antarctica by India.

A computer software has been developed for calculating the diffraction pattern produced on the ground for a plane radio wave traversing through elongated plasma irregularities. Multifrequency scintillation patterns have been computed for a given set of irregularities by placing them at two different heights, viz. 250 km and 400 km. It has been shown that amplitude scintillations, up to 4 GHz frequencies can be caused by a number of discrete but dense irregularities at these frequencies.

A detailed analysis of interfering signals at different frequencies in VHF and UHF bands in India has indicated that the ITU-R interference predictions are not suitable for tropical conditions where abnormal propagation conditions prevail for large time percentages. A new prediction technique, taking into account all the propagation mechanisms, is being developed for India.

The design and development of the front end of the microwave radiometers in the portable commercial mode at 9.6 and 11 GHz has been completed with perfection in an absolute calibration mechanism. An additional microwave receiver on the PC boards using CAD software has also been fabricated. This includes 60 MHz pre and I.F. amplifier with a detector, low noise amplifier and a phase sensitive detector. A set of attenuation values using microwave radiometric measurements at 19.4 GHz have been evolved for clear weather, cloudy and rainy conditions, which can be used by those planning for reliable communiction systems in the microwave/mm wave regions.

Honours & Awards

Many scientists were awarded for their outstanding work during the year: Dr Rina Sharma received the CSIR Young Scientist Award. Dr Krishan Lal was conferred the Daulat Singh Kothari Memorial Lecture Award of Indian National Science Academy. Dr Subhas Chandra and Dr R.G. Sharma received MRSI Lecture Medal Awards (1996). Dr S.K. Sharma was elected member of Asia Pacific Societies of Electron Microscopy (CAPSEM). Prof. E.S.R. Gopal was re-elected president of Ultrasonic Society of India, Instrument Society of India and Metrology Society of India. ❑

Processes Licensed/Demonstrated and Sponsored/Consultancy Projects, and Technical Services taken up by CECRI

THE Central Electrochemical Research Institute (CECRI), Karaikudi, has licensed the process on Silver-Silver Chloride electrode to M/s Jit & Jit Scientifics, Chennai [Lumpsum premium (LP) Rs 50,000, Recurring Royalty (RR) 2.5%, Period of License (PL) 7 yrs]. This process was also demonstrated to the party.

The process on Lead acid batteries was demonstrated to M/s Usha Gautham Batteries, Hyderabad.

The sponsored projects taken up include: (i) Development of a suitable method for the reclamation of mercury from the effluent aluminate/sludge generated at NALCO's Gallium Plant (National Aluminium Company, Bhubaneswar; Rs 255,000); (ii) Monitoring of seabed and water quality parameters at Tuticorin Port Waters for environment control (Tuticorin Port Trust, Tuticorin; Rs 400,000); (iii) Structure property relationships among modified electrodes of metal hexacyanoferrates and their analogues (Indo-US Collaborative Project; Rs 300,000).

The consultancy projects taken up by the institute in the recent past include: Decorative gold plating of low-cost jewellery (Cochin Fine Chemicals, Cochin; Rs 25,000).

The institute offered technical services for: (i) Testing of organophosphonate samples for scale formation control (Neyveli Lignite Corporation, Neyveli; Rs 20,000), and (ii) Hard anodizing of AA1100 aluminium alloy (M/s Burhani Engineering Industries, Bhopal; Rs 15,000). ❑

Electroplating '97

THE Swadeshi Science Movement (SSM), in association with the Central Electrochemical Research Institute (CECRI), Karaikudi, organized a two-day seminar 'Electroplating '97', in Tamil, at Coimbatore on 4-5 October 1997.

The seminar was sponsored by the Coimbatore Electroplaters Association, and Electroplaters and Metal Finishers Association of Tamil Nadu, Madurai, and supported by CSIR and Tamil Nadu State Council for Science and Technology, Chennai.

About 230 delegates from all over Tamil Nadu participated in the seminar.

Shri Gopalakrishnan, Mayor of Coimbatore, inaugurated the seminar and Prof. G.V. Subba Rao presided over the function. Dr V.S. Muralidharan, Vice President, SSM, welcomed the gathering and Dr K.N. Srinivasan, Treasurer, read the messages received on the occasion, Shri S. John, Convener and Head, IMF Division, gave an introduction to the seminar. Shri Veluohamy, Vice Mayor, released the sourvenir. Shri Ranganathan, President, CODISSIA; Shri K.M. Ram Doss, President, CEMA; Shri M.P. Murugesan, President, EPMFAT; Dr M. Raghavan and Dr R. Vijayavalli, Deputy Directors, offered felicitations.

Main focus of the seminar was on the pollution abatement and wastewater management. Recent developments in the field of electroplating for decorative, protective and functional applications were highlighted by 20 scientists. In all, six technical sessions were held. Topics of the lectures included basics of electroplating, pretreatment processes, copper/nickel/chromium plating, hard chromium plating, zinc/cadmium plating, gold/silver plating, alloy plating, electroless plating, composite coatings, electroforming, wastewater treatment, analysis and bath control, testing of deposits, maintenance of plating baths, phosphating and powder coating. A 'question and answer' session was also held and more than 50 industrial problems were discussed and remedial measures recommended. Demonstrations on bath analysis/control and wastewater treatment were also held.

Shri Santhanam, Coimbatore District Collector, delivered the valedictory address. Recommendations of the seminar were presented by Shri S. John, which include setting up of an extension centre of CECRI at Coimbatore for the benefit of electroplating and other electrochemical industries; creation of a new 'Electroplating Nagar' for segregating the plating industries for centralized wastewater treatment; and formation of a new society on Surface Engineering for the advancement of the finishing field. Shri R. Rajasekar, Secretary, proposed a vote of thanks. ❑

National Congress on Corrosion Control

THE Seventh National Congress on Corrosion Control was organized by the National Corrosion Council of India (NCCI) at Holiday Inn Krishna, Hyderabad, during 17-19 September 1997, in collaboration with the Central Electrochemical Research Institute (CECRI), Karaikudi, and Indian Institute of Chemical Technology (IICT), Hyderabad. The congress was sponsored by M/s Nagarjuna Fertilizers & Chemicals Limited, Hyderabad, and co-sponsored by M/s Asia Engineering Company, Secunderabad; M/s Coromandel Fertilizers Limited, Secunderabad; Council of Scientific and Industrial Research, New Delhi; Department of Ocean Development, New Delhi; Department of Science and Technology, New Delhi; and M/s Devika Chemicals, Mumbai. Nearly 200 delegates from major public sector undertakings, R&D and educational institutions, fertilizer industries, sugar industries, etc. participated.

The congress was inaugurated by Shri K.S. Raju, Chairman & Managing Director of Nagarjuna Group of Companies, Hyderabad. Dr K.V. Raghavan, Director, IICT, presided over the inaugural function. Dr N.S. Rengaswamy, Chairman, NCCI and Head of the Division of Corrosion Science & Engineering, CECRI, Karaikudi, welcomed the gathering.

Prof. G.V. Subba Rao, Patron, NCCI and Director, CECRI, made a brief mention about the congress and NCCI and expressed happiness that the two CSIR laboratories namely CECRI and IICT are actively involved in organizing this congress along with NCCI.

Shri K.S. Raju during his inaugural address referred to the depleting natural resources due to corrosion which means loss of wealth and value. He called for a holistic approach for conserving such natural resources.

Dr K.V. Raghavan, Director, IICT, inaugurating the Seventh National Congress on Corrosion Control

Dr K.V. Raghavan in his presidential address stated that corrosion in chemical processing plants is assuming an alarming proportion. He called for continuous on-line monitoring of corrosion in commonly susceptible areas such as joints, weldments and multiphase systems in the industrial environments. He also stressed the need and importance of a corrosion audit.

Dr M. Yaseen, Sr. Deputy Director & Head, Organic Coatings and Polymers Division, IICT, and Chairman of the Souvenir Committee of the congress spoke about the contents of the souvenir and acknowledged all the contributions received through advertisements and messages.

Dr K. Gopalan, Director-in-charge, National Geophysical Research Institute, Hyderabad, released the souvenir.

Prof. K.I. Vasu, Founder patron NCCI and former Director of CECRI released the 'Code of practice for corrosion protection of reinforcing steel using cement-polymer composite coating system' and offered his felicitations.

Shri P.F. Anto, Dy. General Manager, IEOT, ONGC, Panvel, and Vice Chairman of NCCI released a brochure on Corrosion Monitoring for Corrosion Control.

Prof. G.N. Mathur, Director, DMSRDE, Kanpur, declared open an exhibition put up on the occasion. CECRI; M/s Empire Chemicals, Mumbai; M/s KLB Instruments Co. Pvt. Ltd, New Delhi; M/s KJB Titanium (P) Ltd, Chennai; M/s Solvosol Paints Pvt. Ltd, Hyderabad; and M/s Titanium Tantalum Products Ltd, Chennai, took active part in the exhibition by displaying their products.

Shri P.R. Menon, Director-Technical, Nagarjuna Fertilizers and Chemicals Limited, Hyderabad, and Chairman of the Organizing Committee of this congress handed over the mementoes to the various dignitaries and expressed happiness over the awareness and response this corrosion congress had generated and hoped that the three day's deliberations would be highly fruitful.

Dr N. Palaniswamy, Asst. Director, CECRI, and Secretary NCCI, proposed a vote of thanks.

Invited Lectures

Shri R.K. Sabharwal, Executive Director (O), IOCL, New Delhi, presented in his invited talk on Corrosion in Oil Refining Industry, the corrosion problems encountered in the selection of materials of construction in the oil refining industry. He mentioned that some of the cooking units needed replacement within seven years due to bulging of the bottom and cracks at welds. He advocated modified design for overcoming such problems in the fabrication of reactor units. He also referred to the acid corrosion in the overhead system of crude distillation column, corrosion in the internal surface of the floating roof tanks shell storing motor spirit, corrosion in the catalytic reforming unit in the effluent coolers and downstream piping. He concluded by suggesting suitable remedies for the above mentioned problems.

Corrosion problems encountered in sugar industries were elaborated by Shri S.P. Jain, Dy. Chief Engineer, Daurala Sugar Works, Daurala. He elaborated on the corrosion problems which start right at the beginning when the cane preparation starts to that at the offseason when washing the plant creates a corrosive atmosphere. He suggested that the use of 409M stainless steel could solve many of the corrosion problems encountered by sugar industries.

Shri P.F. Anto, Dy. General Manager (C&M), IEOT, Panvel, enlightened the delegates on the various corrosion problems encountered in the oil and gas installations both offshore and onshore platforms. He cautioned that the corrosion damage due to biofouling may cause leakage of noxious substances. He underlined the importance of proper selection of materials. Cathodic protection also found an important place in his lecture. He stressed that oil exploration in the deep seas offers a good avenue for further research in corrosion mitigation programmes.

Dr M. Yaseen, Sr. Dy. Director & Head, Organic Coatings & Polymers Division, IICT, gave an interesting talk on Speciality Coatings.

There was a special lecture by Dr M.B. Deshmukh, Head, Corrosion & Electrochemistry, NMRL, Mumbai, on 'Quality Standards: Ignored Factor of Corrosion'. He stressed the need for integrated quality management in corrosion and specified the ignored factor of corrosion in the standards and audit measures. He pointed out that there is no reference to corrosion safety in the standards, and also highlighted the grey areas that could prove important for fundamental studies in corrosion.

Shri Paul Vikijan of Cortec Corporation, USA, spoke about measuring the effectiveness of migrating corrosion inhibitors by electrochemical techniques, which could prove useful in the protection of concrete structures.

Status Reports

The following scientists from Central Electrochemical Research Institute, Karaikudi, presented the status report on the recent developments in their respective fields: Dr T. M. Balasubramanian (Corrosion Inhibitors), Dr P. Jayakrishnan (Protective Coatings), Dr G. Venkatachari (Corrosion Monitoring), Dr N. Palaniswamy (Cathodic Protection), and Shri S. Srinivasan (Corrosion Control in Concrete Structures).

Technical Sessions

Oral presentations were made under the following five technical sessions: (a) Corrosion problems in industries and failure analysis (Seven papers were presented, which dealt with respective corrosion problems faced by paper and pulp, process, oil and natural gas and aerospace industries), (b) Corrosion inhibitors (Nine presentations were made varying from cooling water inhibitors, pickling inhibitors to novel inhibitors for existing systems), (c) Role of organic coatings in corrosion control (11 presentations were made on a variety of coatings and their protective capabilities for varied applications. This session was quite an interesting one and saw numerous debates on the role of various components of the coating systems. The industrialists stressed the importance for more integrated approach between research and field applications), (d) Cathodic protection (Presentations were made on biological corrosion and basic aspects of corrosion, instrumentation for cathodic protection case studies and role of hydrogen and hydroxyl ion in cathodic disbondment), and (e) Corrosion in concrete and corrosion resistant materials (In this session, there was an interesting mention about a galvanizing system, an impressive presentation on the influence of freshwater bacteria on reinforced concrete and a few case studies on the importance of corrosion prevention in concrete. A presentation covered corrosion characteristics of HSLA steel in marine environments).

In addition, 30 poster presentations were made evoking a lively discussion.

Panel Discussion

A panel discussion was held on Industrial Corrosion Problems of Relevance to Andhra Pradesh. Dr T.V.S.R. Appa Rao, Director, SERC, Chennai, chaired this session. Other panel members were: Prof. K. I. Vasu, Dr M. Yaseen, Dr S. P. Jain, Dr P. Narayanan Kutty, Shri S.K. Khanna, Shri V. R. Subramanian, Dr N.S. Rengaswamy, Shri K.S. Shrama and Shri Partha Jana.

Dr Appa Rao briefly described about the importance of having reliable field instruments for testing the safety of building and structures. He also mentioned about residual life prediction and emphasized on the need for bringing out an appropriate code of practice.

Shri S.P. Jain, enumerated the various corrosion problems encountered in sugar industries and stressed on the need to address these problems through corrosion experts. The major source of this problem is low *p*H juice, the sulphitation process which produces SO_3, he described. He felt that proper choice of material for, e.g. SS409M, would help mitigate the problem to a large extent.

Shri S.K. Khanna, Chief Engineer from CPWD, New Delhi, suggested that the corrosion science and engineering should be taught as a special subject in the civil engineering curriculum. He stated that the CPWD is quite aware of the corrosion problems and special efforts are being made to repair and rehabilitate damaged structures.

Dr P. Narayanan Kutty, Dy. Manager (Corrosion Control), HOCL, Raigad, emphasized that corrosion science and engineering should be a practical profession rather than an R&D programme. He mentioned that roughly out of Rs 5000 million, Rs 200 million is being spent on repair and maintenance. Such huge amounts, he said, could be brought down to a minimum by proper application of corrosion control measures. He also suggested introduction of ISO standards for corrosion control. He also referred to an 'equivalent material syndrome' which may lead to catastrophic failures, and called upon the industries to recruit more corrosion engineers.

Shri K.S. Sharma, Sr. Manager (Civil) from Nagarjuna Fertilizers & Chemicals Limited, Kakinada, stated that his management was strongly committed to solving corrosion problems. However, he felt that laboratory studies may have only decimal relation to actual field problems and there is a need for coordinated effort. Cost effectiveness is one of the important criteria. Regarding corrosion auditing, he mentioned that corrosion control standards for each and every industry should be set before the industry is asked to go in for a corrosion audit.

Shri Partha Jana, Sr. Dy. Manager, GAIL, Vijaipur, desired that NCCI should take initiative to specify standard procedures for corrosion auditing. An audit committee could also be formed in this regard. He also made a mention about the importance of corrosion control measures in mines where corrosion problems are encountered mostly in the ventilators.

Shri V.R. Subramanian, Executive Director, ILZIC, Bangalore, made a plea for the formation of Indian Institute of Corrosion Engineers. He suggested formation of statewise councils with a view to expanding the activities of the National Corrosion Council of India. He desired to have a separate session for architects and builders.

Prof. K.I. Vasu, while winding up the panel discussion, informed that NCCI has already taken in to the book various suggestions put forth and that appropriate follow-up action would be taken. He also informed the gathering that NCCI has passed three important resolutions at its ninth meeting.

1. Coating on Steels used for Multistorey Buildings and Bridges: It has been observed that failure of many concrete structures, particularly multistorey buildings and bridges, is owing to rebar corrosion. This problem can be solved by using several novel, field tested and cost-effective coating systems available indigenously. The Ministry of Surface Transport has made provisions for such coatings on steels used for major bridges.

The council resolved to request the Government of India to evolve statutory provision for protection of steel for all multistorey buildings and bridges in the country. It should be made mandatory for these structures to follow appropriate 'Code of Practice'.

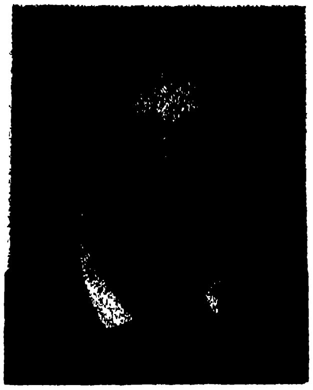
2. *Corrosion Audit*: Of late, it has been noticed that unexpected and catastrophic failures occur in some major industries and structures as a result of metallic corrosion as precursor. There are institutions in India who have considerable experience and expertise in condition survey of such structures. The condition survey of bridges for corrosion failures has been undertaken in a few cases. The Thane Creek Bridge was made safe after such a condition survey. However, there is no mandatory provision for such corrosion surveys for bridges (over 700 bridges are under distress now) and multistorey buildings under distress. NCCI feels that periodic Corrosion Audit should be statutorily made mandatory for all major bridges and buildings more or less like environmental impact analysis or energy audit.

NCCI resolved to request the Government of India to evolve statutory provision for periodic condition survey and corrosion audit of all major concrete and metallic structures in buildings and bridges as well as major industries and appropriate preventive and periodic maintenance to avoid catastrophic failures.

3. *Corrosion Map of India*: Because of the varying nature of the corrosive atmosphere in industrialized areas of the country, the right type of materials and corrosion preventive coatings are not being selected and given. This often leads to premature failures and losses. The best guide in such cases would be to have an authentic Corrosion Map of India updated every 10 years. There is no such guide map available now in India except the one prepared some 30 years ago. Many organizations have piece-meal data. NCCI feels that it is time that all the available data are pooled together and new authentic data generated for preparing a reliable Corrosion Map of India with respect to materials and coatings. This can be done by establishing some 150 field stations and 50 core centres for collecting corrosion data spanning over a period of five years. This should be a national project. It is estimated that this national effort may need a five year funding of approximately Rs 150-180 million. NCCI resolves to request the Government of India to make this as a National Project of high priority under the Planning Commission and get it implemented through CSIR laboratories under the guidance of NCCI. ❑

Shri Ajay Kumar appointed Joint Secretary (Adm.), CSIR

SHRI Ajay Kumar, IAS, has taken over charge of the Office of Joint Secretary, Department of Scientific & Industrial Research (DSIR), and Joint Secretary (Adm.), Council of Scientific & Industrial Research (CSIR), New Delhi, w.e.f. 1 December 1997. Prior to the present assignment, he was Joint Secretary, Inter State Council, Ministry of Home Affairs, New Delhi.



Born on 30 January 1951, Shri Ajay Kumar did his B.A. (Hons.) (Political Science) from the Patna University in 1969, M.A. (Political Science) from the University of Delhi in 1972, L.L.B. from the Patna University in 1986 and M.A. (Rural Development) from the University of East Anglia, Norwich, U.K. He taught Political Science as Lecturer in Rajdhani College of the University of Delhi for four years (July 1972-July 1976).

He was selected for the Indian Administrative Service in July 1976, and has served as: Sub-Divisional Development Officer of Buxar, Bihar (July 1978-July 1980); Deputy Development Commissioner in Rural Development Department, Government of Bihar (July 1980-Nov.1981); Managing Director of Bihar State Warehousing Corporation, Government of Bihar (Nov. 1981- Nov.1983); Joint Secretary, Deptt. of Food, Civil Supplies and Commerce, Government of Bihar (Nov. 1983-May 1985); Deputy Commissioner and District Magistrate, Deogarh, Bihar (May 1985-Sep. 1986); Director, Employment and Training, Government of Bihar (Oct. 1986-July 1988); Deputy Commissioner and District Magistrate, Hazaribagh, Bihar (July 1988-Aug. 1989); Vice Chairman, Patna Regional Development Authority, Government of Bihar (Oct. 1989-July 1990); Special Secretary, Deptt. of Planning, Govt. of Bihar (July 1990-March 1993); Managing Director, Bihar State Agro Industries Development Corporation, Govt. of Bihar (March 1993-Oct. 1993); Director and Chief Vigilance Officer, Deptt. of Supply, Ministry of Commerce, Govt. of India (Oct. 1993-Sep.95); and Joint Secretary, Inter State Council, Home Ministry, Government of India (Sep.-Nov. 1997). ❑

HONOURS & AWARDS

Dr S. Sivaram

DR Swaminathan Sivaram, Head, Polymer Chemistry Division and Scientist in the Directors Grade, National Chemical Laboratory (NCL), Pune, has been elected to the Fellowship of the Indian National Science Academy, New Delhi. The Fellowship which becomes effective from 1 January 1998, is in recognition of his distinguished contribution to polymer chemistry.

Dr Sivaram's contributions to polymer chemistry are rated among the outstanding ones in the area. He received his Ph.D. from Purdue University, working under the guidance of professor H.C. Brown, Nobel Laureate. He was a Research Associate at the University of Akron, Ohio, USA. He joined IPCL in 1973 and was associated with the task of setting up the first industrial petrochemical and polymer R&D Centre in India. He rose to the position of Deputy General Manager (R&D) at IPCL. He joined NCL in 1988 as Head, Polymer Chemistry Division. His research interests are in controlled polymer synthesis using anionic and group transfer polymerization methods, chemistry of polyolefins, high performance polymers and polymer surface modification. He has published over 160 papers in peer reviewed journals and has fifty patent applications to his credit. He has been granted several U.S. patents during the last few years, many of which have been licensed to companies, both in India and abroad. Under his guidance, the Polymer Chemistry Division of NCL has matured into one of the foremost centres of advanced research and has made impressive contributions to both fundamental and applied research.

Dr Sivaram has also been awarded recently, the Professor Santi Ranjan Palit Memorial Biennial Award in Polymer Science by the Indian Association for the Cultivation of Science, Calcutta, and the Distinguished Alumnus Award, by the Indian Institute of Technology, Kanpur. ❑

OBITUARY

Dr A.K. Gupta

AN eminent transportation engineer and Director of Central Road Research Institute (CRRI), Dr A.K. Gupta left for his heavenly abode in London on 6 November 1997. He was on his way back to India after attending PIARC (World Road Association) C-3 Group meeting in Manchester, UK. Dr Gupta was 53 years old and is survived by his wife and two children.

Dr Gupta had obtained his Master's degree in Transportation Engineering and Systems in 1971 from AIT, Bangkok, Thailand, and Ph.D. in Transportation Engineering from University of Roorkee in 1981.

He had joined University of Roorkee in 1972 as Lecturer and became Professor in 1985. He co-ordinated the activities of the Centre of Transportation Engineering at University of Roorkee as its founder Co-ordinator, from 1985 till taking over as Director, CRRI, on 16 August 1996.

He had to his credit over 165 technical research papers published in various reputed Indian and international journals and conferences, symposia and seminars proceedings; and over 50 major R&D reports relating to various national and international consultancy projects. He was associated in various capacities with several national and international professional bodies like TRB (USA), TRF (Canada), WCTRS (Paris), PIARC (Paris), and ARRB (Australia). He was a Professional Affiliate of IRF (USA) and Member WUT (Canada).

Dr Gupta had a series of national and international awards to his credit, including the Netherland's Government Award (1971), IE(I) UPSC Award (1976), Khosla Commendation Award (1982), Khosla Research Prizes and Medals and Cash Awards (1987-91, 1993, 1994 & 1996), IRC 'Best paper on research' Medal and Citation (1989), IE(I) Certificate of Merit (1990 & 1994), President of India Prize (1991) for outstanding paper by IRC (1991), S.R. Mehra National Memorial Research Award (1996), American Biographical Institute - International Award and Citation (1996) and New York Academy of Science Award (1997).

In a short span of about fifteen months he made the CRRI, presence felt in its areas of activity. He was also very active in social, voluntary and cultural activities. ❑

ANNOUNCEMENTS

Industry-User-R&D Interaction Meet on Bio-medical Instrumentation for Health Care

THE Central Scientific Instruments Organisation (CSIO), Chandigarh, is organizing an Industry-User-R&D Interaction Meet on Bio-Medical Instrumentation for Health Care during 22-24 December 1997 at CSIO. The meet is being sponsored by CSIR, TIFAC, DST, DoE & AICTE.

The Medical Equipment Division of Confederation of Indian Industry will be playing a lead role. Besides medical instruments industry, R&D organizations, well-known clinicians, government agencies (DST, DoE, TIFAC), and international organizations like UNICEF will participate in the meet.

Keeping in view the slow pace of growth of the medical instruments industry in India, the proposed meet aims to encompass the Bio-medical Instrumentation in India, covering R&D efforts, problems of the Indian medical instruments industry, covering the imported vis-a-vis Indian technology, issues relating to technology transfer, futuristic R&D directions, human resource development and repair and maintenance aspects.

The meet will provide an opportunity to the leading industries, distinguished clinicians and R&D scientists in this field to share their views and evolve policy decisions for accelerating the growth of medical instruments industry and making it technologically competitive.

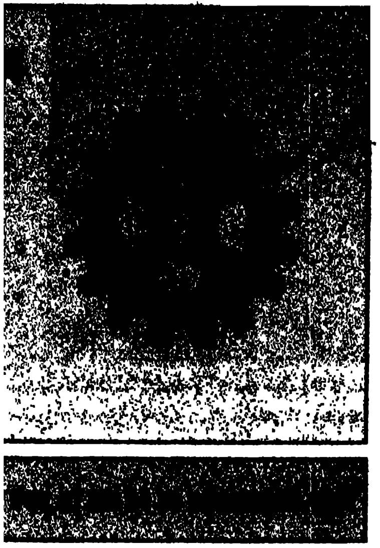
The meet will have following six technical sessions: Status of Medical Instruments Industry in the Country — Problems and Gaps; R&D Efforts in Medical Instrumentation — Present and Future; Accelerating Transfer of Technology — Building Consortia among Industry, Users and R&D Organizations; Panel Discussion on Vision of Indian Medical Instruments Industry — Direction for R&D; Structuring R&M Services for Medical Instruments; Developing Human Resources for Bio-Medical Engineerig.

For further details, please contact: Director, CSIO, Sector 30, Chandigarh - 160 020; Tel. 0172-657190, 657614; Fax 0172-657267, 657082. ❑

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit

Annual Subscription : Rs. 60
Editors : Dr B.C. Kashyap and Dr C.S. Gupta **Editorial Assistant : Neelima Handoo** **Production : Kaushal Kishore** **Single Copy : Rs. 3.00**
Phone : 5786301 Gram : PUBLIFORM Telex : 031-77271 E-mail: niscom@sirnetd.ernet.in. Fax : 5787062
RN 4512/57

ISSN 0409-7467



CSIR NEWS

International Conference on Frontiers in Biotechnology —ICFB'97

BIOTECHNOLOGY has tremendous potential for accelerating the growth in vital sectors, such as agriculture, health, drugs & pharmaceuticals, industrial chemicals and environmental management. This is one of the major observations made at the International Conference on Frontiers in Biotechnology (ICFB'97), held in Thiruvananthapuram during 26-29 November 1997. The conference was organized by the Regional Research Laboratory (RRL), Thiruvananthapuram, in collaboration with the Department of Biotechnology (DBT), Government of India, New Delhi. Over 300 biotechnologists, biologists, chemists and others, including around 60 participants from as many as 25 countries attended. Sixty-six plenary/invited lectures were presented' in 12 pairs of technical sessions. In addition, around 180 papers were presented in poster sessions. A panel discussion session was also held in which experts from India and abroad presented their views on the 'Status of Biotechnology in 2010'.

Inaugural Session

The conference was inaugurated by Dr S. Varadarajan, President, Indian National Science Academy, New Delhi.

Welcoming Dr Varadarajan and the distinguished participants to the conference, Dr G. Vijay Nair, Director, RRL-Thiruvananthapuram, who was also Chairman of the Organizing Committee of ICFB'97, expressed his happiness over the presence of such a large number of eminent scientists from all parts of the globe. He said that in the history of human civilization of around 10,000 years, the last two centuries have witnessed significant qualitative and quantitative changes in human health, wealth and welfare. The large number of fundamental discoveries in physics, chemistry and biology made during this period led to technologies of vital importance to mankind. The industrial revolution that began at the start of the present century brought prosperity to many nations, particularly those in the western block. But India missed it. Today, we are at the threshold of an even more exciting and, hopefully, more beneficial industrial revolution. Biotechnology, which is a combination of many areas in biology, chemistry, physics and engineering, will be the backbone of this new revolution. This revolution is poised to make far reaching changes in our lives and the lives of our future generations. And the thrust of global developments in biotechnology is going to be in drugs and pharmaceuticals, food and chemical sectors. The application of biotechnology will play a major role in eradication of hunger and poverty, opined Dr Nair.

Dr Nair stressed that for countries like India, which missed the industrial revolution earlier, biotechnology offers tremendous opportunity to harness their natural resources and be a major partner in the ensuing revolution.

Prof. H. Veeramani from the Centre for Environmental Science & Engineering, IIT, Mumbai and Co-convener of the conference, elaborated the focal theme of the conference and the boundless scope of biotechnology, particularly in the Indian context. He emphasized that India, which is predominantly an agrarian country, has a vast reservoir of raw materials. Many of these remain underutilized and could be processed into value-added products through the application of biotechnology. Prof. Veeramani also gave an outline of the conference programme.

Calling the conference a momentous event, Dr Varadarajan in his inaugural address pointed out that biotechnology needs the involvement of all scientific disciplines. It has broken all barriers between the various disci-

Left — Dr S. Varadarajan inaugurating the International Conference on Frontiers in Biotechnology. Seated on the dais (*from left*) are: Dr Ashok Pandey, Prof G. Maass, Dr G. Vijay Nair and Prof. H. Veeramani. *Right* — A view of the audience

plines of science, and boundaries between the nations. In fact, today, nobody can work in isolation, he emphasized.

Highlighting the progress of S&T in India, Dr Varadarajan said that this year we are celebrating 50th anniversary of our Independence. As we look back, we find that we have made long strides in the field of agriculture, healthcare, and so on. Today, in spite of our large population growth, we are able to feed our millions. The average life expectancy has gone up and infant mortality rate has come down. We have made significant progress in almost every sector. And this has been largely possible due to the government support to S&T.

But much more has to be done, Dr Varadarajan emphasized. For example, in the case of energy, our per capita energy consumption is much less than that in the developed countries. We have to work for sustainable development, development of green technologies that would lead to optimum use of our natural resources, and allow us to compete with other nations. Stating that knowledge is power, he urged the scientists to develop biotechnologies for optimum utilization of byproducts and wastes, and for producing drugs to treat diseases such as AIDS and TB.

Dr Varadarajan's inaugural address was followed by the keynote address of Prof. G. Maass from Gesellschaft für Biotechnol Forschung, Germany. In this address on 'The Catalytic Mechanism of Restriction Enzymes', Prof. Maass unveiled the mystery behind the 'substrate-assisted catalysis' of Type II restriction enzymes by non-specific DNA binding followed by a series of dissociation-association reactions to culminate in the cleavage of DNA at a specific site. His talk focussed on the enzymology of Eco RI with particular emphasis on its mechanism for DNA recognition and cleavage. The conformational changes of the enzyme activate the catalytic centre and results in the DNA cleavage. Typical of this process is mechanism of the substrate-assisted catalysis. Prof. Maass's thought provoking talk on these wonderful biocatalysts concluded with an invitation to his counterparts to join him in this tedious venture for the human cause.

Dr Ashok Pandey, Scientist, RRL-Thiruvananthapuram and Convener of the conference, proposed a vote of thanks.

Technical Sessions

The session II had a talk on 'European Commission's Training and Mobility of Researchers (TMR) Programme' by Dr F. McSweeney, European Commission, Belgium. He said that TMR programme's aim is to provide the community with top-level S&T personnel. This programme is open to virtually all scientific disciplines, from natural sciences to several aspects of economic, social and human sciences.

In session III A, Dr D. Mitchell, Department of Chemical Engineering, The University of Queensland, Australia, spoke on 'Towards Rational Design and Operational Criteria for Solid-state Fermentation Bioreactors (who also chaired the session) and Dr G. Szakacs, Technical University of Budapest (on behalf of Prof. R.P. Tengredy, Colorado State University, USA) on Solid Substrate Fermentation (SSF) in Industrial and Agricultural Biotechnology. Dr Mitchell discussed the various designs of bioreactors that have been used in SSF research, their trays, packed beds, rotating drums, air- solid fluidized beds and so on. He also spoke on specific problems such as overheating owing to difficulty in removing the metabolic heat released during fermentation. Dr Szakacs highlighted the superiority of SSF in obtaining valuable fine chemicals and valuable food products. Secondary metabolites produced by SSF, such as antibiotics, monensin, citric acid, gibberellins and enzymes may be used as feed supplements, biopesticides and growth promoters. *In situ* produced enzymes may be used in ensiling, bioprocessing of crops and crop residues, pulp and paper industry and in directed compositing, he pointed out.

Session III-B was chaired by Prof. R. Marchant. Prof. Veeramani spoke on 'Environmental Management incorporating Biotechnology Developments', and Prof. R. Bhamidimarri from the Massey University, New Zealand, on 'Advances in the Biotechnology Applications in Remediation of Toxic and Inhibitory Pollutants'. In his talk, Prof. Veeramani pointed out, "with a better understanding of the biochemical pathways of degradation of environmental pollutants, and a wide choice of novel proprietary/generic designs of bioreactors, the environmental biotechnologists are well equipped to offer efficient process designs and package systems for achieving regulatory compliance. Biological systems are now designed incorporating anaerobic, aerobic and anoxic phases in multistage sequences for handling petroleum refinery, petrochemical, paper, fertilizer, distillery, cooking and coal gasification and other allied complex process wastewaters". He also made a comprehensive survey of the present trends and developments in processes and systems, and the experiences gained along with the potential gaps and future needs of the industry on bioremediation of toxic and inhibitory pollutants. Prof. Bhamidimarri spoke about the treatment of naturally occurring organic compounds. Biological systems present a preferred treatment option for such pollutants over the physical or chemical methods because the former are environmentally and economically more attractive. The application of biotechnological processes for the treatment of toxic and inhibitory compounds have been increasing over the last two decades, as the fate of such substrates in a biotreatment process is best understood.

Session IV-A was chaired by Prof. G. Maass. Dr B.K.C. Patel, Griffith University, Australia, made a presentation on 'Molecular Methods for Finding New Thermophillic Microbes and Their Biotechnological Potential', and Prof. S. Chand, IIT, New Delhi, on 'Application of Enzymes in Textile Processing'. Dr Patel described the molecular methods such as rRNA gene sequencing for finding new thermophilic microbes and their biotechnological potentialities. Since most of the food manufacturing industries operate at elevated temperatures, especially above 60°C, exploiting thermophilic microbes for novel thermostable enzymes is one of the thrust areas in enzyme biotechnology. Prof. Chand explained that mostly, biomacromolecules such as cellulose in cotton and jute, protein in silk, wool and leather, besides gum and waxes are contaminants present therein. In different steps of the processing of these macromolecules specific enzymes (especially as a mixture) can be used to improve the quality and value of the fabrics.

Chaired by Prof. Bhamidimarri, the Session IV-B had presentations by: (i) Prof. R.M. Kothari, North Maharashtra University, Jalgaon, on 'Microbial Conversion of Ligno-Cellulosic Wastes into Soil Conditioners', and (ii) Prof. R. Marchant, University of Ulster, North Ireland, UK, on 'White-rot Fungi as Agents for Bioremediation'. Prof. Kothari presented the work of his group on isolation of a number of novel strain of microbes specific to waste from major raw materials in pulp and paper industry and their utilization for value-addition by conversion into soil conditioners. The technical feasibility of the process relies upon its easy adaptablity by illiterate masses for large-scale utilization in agro-forestry, horticulture and forestry and thus it qualifies to be a sustainable bioresource for improving the soil fertility and productivity in the Indian context. Prof. Marchant disclosed the biological potentialities of white-rot fungi for the degradation and decolorization of various dyes. He elaborated his views taking bioremediation of textile dyes as a model, on appropriate bioreactor design. He also described the specific enzyme capabilities of the white-rot fungi and presented experimental results to illustrate how some commonly used textile dyes could be degraded by these organisms.

The second day of ICFB'97 had sessions V-VIII. The first presentation in Session V-A was by Prof. A. A. Koutinas, University of Patras, Greece (who also chaired the session), on 'New Aspects of Fermentation Technology'. Low temperature fermentation; production of nutrition food through fermentation; industrialization of immobilized cells, especially in the alcoholic fermentation; catalytic multiphase fixed bed tower bioreactor were discussed. Also discussed were the wine and single cell protein and the importance of isolating psychrophilic, thermophilic and osmophilic organisms in biotechnological developments. 'Fluxes Resolved and Fluxes Increased — A Detailed View on Intracellular Fluxes to Obtain Superior Amino Acid' was the title of the second presentation. Dr L. Eggeling, Institute für Biotechnologie Forschungzentrum Julich GmbH, Germany, in this talk described the successful cloning of a specific exporter for L-lysine by his group. Dr S. Singh, ML Sultan Technikon, South Africa, illustrated the 'Properties and Application of β-xylanases from A Novel *Thermomyces lanuginosa* SSBP Strain'. Dr I.K.P. Tan, University of Malaya, Malaysia, in his talk on 'Production, Characterization and Industrial Applications of Polyhydroxyalkalkaonates' explained the superiority of PHA over conventional petrochemical-derived plastics in terms of its biocompatibility and potential application in the biomedical field such as surgical devices, drug delivery systems and artificial skins.

Session V-B was chaired by Prof. M.V. George. Prof. A. Vasella, ETH, Switzerland, spoke on 'Inhibition of β-Glycosidase Neutral Inhibitors' such as carbohydrate-derived fused heterocycles and the importance of hydrogen bonding and electrostatic interactions. Dr B. Fraser- Reid, Natural Products and Glycotechnology Research Institute, USA, made a presentation on 'Glycosylphosphatidyl Inositols (GPIs) Membrane Anchors — Potential Therapeutic Agents of Third World's Infectious Diseses'. The oligosaccharide, GPIs, are found in the malaria toxin-2 as the causative agent, and this raises the hope for development of a carbohydrate-based malaria vaccine, he explained.

In Session VI-A, chaired by Dr David Mitchell, Dr T. Satyanarayana, University of Delhi (South Campus), spoke on 'Production and Applicability of Xylanases in Eco-friendly Paper Pulp Bleaching'. He critically evaluated the feasibility of SSF and SmF systems for xylanase production.

Dr M.C. Wani, Research Triangle Institute, USA, and Dr V.L. Narayanan, National Cancer Institute, Bethesda, USA, made presentations respectively on 'Camptothecins: Current Status and Future Prospects' and 'New Anti-cancer/Anti-AIDS Natural Products leads' in Sesssion VI-B. Prof. S. Ranganathan chaired. Dr Wani illustrated the discovery and development of the antitumor agent, camptothecin and its analogues. This alkaloid is a well-known inhibitor of the nuclear enzyme, Topoisomerase-I, extracted from the Chinese tree, *Comptotheca acuminata*. Dr Narayanan disclosed the methodology involved in screening of preclinical natural products with a view to generating anticancer/anti-AIDS agents. Approaches have been developed to display and compare the screening data, he explained.

Making his presentation in Session VII-A, on 'Ethanol Production using Thermotolerant/Thermophilic Yeast Strains', Dr I.M. Banat, University of Ulster, Northern Ireland, UK, reported the successful isolation of several yeast strains by his group, which are capable of growth and ethanol production at elevated temperatures. Two such strains have been identified as *Kluyveromyces marxianus*, which can grow at temperatures up to 52°C and produce ethanol effectively from a number of substrates at 45°C. Prof. G. Seenayya, Chairman, Department of Microbiology, Osmania University, focused his talk on 'Bioconversion of Cellulosic Biomass to Ethanol by Thermophilic and Anaerobic Fermentation using *Clostridium thermocellum* Strains', which offers a great potential. The main constraint is its low productivity. In a quest to find out efficient strains, his group has successfully isolated *C. thermocellum* strains from various habitats, and purified and characterized these. The strain produced extracellular cellulase on cellulosic raw materials and a few of them produced extracellular β-amylase on starch.

The first of the three lectures delivered in Session VII-B, chaired by Dr D. Ranganathan, Prof. M. Kahn, Molecumetics, USA, explained the power of combinatorial chemistry using 'library approach' based around conformationally constrained secondary structure templates in conjugation with recent advances in structural biology and molecular modelling in accelerating the drug discovery process taking viorolide and a phenalamide as examples. Prof. M. Miyashita, Hokkaido University, Japan, described a new acyclic stereocontrol based on the stereospecific methylation of γ, δ-epoxy acrylates by trimethylaluminium and its application to natural product synthesis. The methodology has a synthetic advantage to be iteratively used for the construction of contiguous asymmetric centres, to be used for the synthesis of biologically active natural products, particularly polypropionate-derived antibiotics such as rifamycins, triandamycins, and streptovaricins. Dr D.S. Grierson, Institut de Chimie des Substances Naturelles, France, unravelled the structural complexity of the enediyne type antitumor agents such as calicheamicin-land esperamicin-A12. His research group has been engaged in development of a synthetic methodology to assess the central core unit of esperamicin and the study of related biologically active compounds responsible for cell death through cleavage of double stranded DNA.

Biotransformation of value-less agroproducts into value-rich economically viable compounds using SSF technology was the focal theme of Drs N. Krieger and R. Banerjee presentations made in Session VIII-A. Dr Krieger's group at Universidade Federal do Parana in Brazil has explored the potential of using agro-industrial residues using cassava waste as solid substrates in SSF, and worked on different processes such as protein enrichment for human and animal nutrition, production of mushroom and metabolites like enzymes, organic acids with successful perspectives. Dr Banerjee explained the experience of his group at IIT-Kharagpur, in the production of gallic acid from the raw materials gallnuts and leaves of *Rhizophus oryzae*. The significance of gallic acid in the pharmaceutical industries for the manufacture of trimethopsin, an antibacterial agent, was highlighted.

In Session VIII-B, Prof. S.A. Lang, Wyeth-Ayerst Research, USA, described the intrinsic oral activity and the synthesis of the amino methyltetrahydrofuryl carbapenems through an alternative synthetic pathway. Dr J.K. Thottathil, The Bristol-Myers Squibb Pharmaceutical Research Institute, USA, spoke on the synthesis of ifetroban, a highly selective thromboxane A2 receptor antagonist with potent antithrombotic and antiischemic activity.

In the first pair of sessions on the third day, four presentations were made in Session IX-A and three in Session IX-B. Session IX-A was chaired by Dr M. Balasubramanian. Dr J. Scriven, ITP, GBF, Germany, talked about 'Training Programme at GBF with special reference to Indian Sub-continent'. She explained background and philosophy of the programme, its broad aims and objectives and an analysis of the feasibility of GBF's training programme in future. She pointed out that biotechnology involves team work in which experts in each discipline such as microbiology, bioengineering, biochemistry and molecular biology should work in tandem. On behalf of Prof. P.G. McKenna, Prof. R. Marchant, University of Ulster, N.Ireland, UK, spoke on the status of developments of bioindustries at his place, Ireland. He also made a panoramic insight into the anticipated economic resurgence in distant future with a 'foresight exercise' and expected an increased inward investment in the life and health technology sector. Prof. P. Khanna, Director, NEERI, Nagpur, advocated for work on sustainable development by judicious blending of environmental biotechnology through environmental monitoring (e.g. of enteric viruses), restoration of environmental quality (e.g. oil spill remediation), resource recovery and utilization (e.g. hydrocarbons from oil sludges), treatment and substitution of non-renewable resource base with renewable resources (e.g. bioconversion of lignocellulose). Dr A. Prakash, (instead of Dr P.K. Ghosh, DBT, New Delhi), portrayed the evolution of biotechnology in India and highlighted the prospects of biotechnology in different sectors of industry in India and projected the entrepreneurial opportunities. He opined that India has taken long strides, especially during the past few years, embracing all the emerging trends in biotechnology.

Session IX-B was chaired by Dr T. Ravindranathan. Dr G.D. Tandon, Hindustan Antibiotics Ltd, Pune, stressed upon the underexploited bioresources, skilled scientific manpower and infrastructural facilities to carry out advanced biotechnogical research. He called upon the Indian entrepreneurs to rise up to the occasion to frame ventures suitable to Indian scene and aid to make a techno-economic evaluation, adding that foreign countries have already started reaping the benefits by controlling the global markets and by effective patent protection.

Dr Ravindranathan, NCL, Pune, explained the biocatalytic resolution of drug intermediates, with special reference to the microbial enzymatic production of optically active compounds, [D(-)phenylglycine) and (R-t-butyl dimethylsilyloxy cyclopent-z-en-1-one, as important intermediates in drug inducing. This method is cost-effective, non-hazardous and pollution free. Such methods have also been employed for the resolution of phenylglycine and prostaglandin intermediates. A challenging technology employing norethindrone acetate, releasing from a subdermal implant, as an effective and acceptable method for long-term contraception, was explained by Dr B.K. Malik, CBT, Delhi. He commenced his talk with special reference to allergy and allergens. In a large group of women seeking contraception, there is no need to make the method reversible during the effective life span of the implant, Dr Malik added.

The Session X-A was held under the chairmanship of Prof. J.M. Meyer, the leader in the research on siderophore, secreted by Pseudomonads. Prof. Meyer's group in the Universite Louis Pasteur, France, has been actively engaged in siderophore research. They have developed a new physiochemical technique called siderotyping for the rapid screening of siderophore producing strains, which was found to be superior to the existing CAS assay, especially for the taxonomy of Pseudomonas and related microbes. Prof. H. Budzikiewicz, Inst. Org. Chem. Univ. Germany, reported the non-ribosomal biosynthesis of complex peptide siderophore catalyzed by multifunctional enzymes via a thiotemplate mechanism. Structures of different siderophores were also discussed in a view of a possible combat against pathogenic bacteria *Pseudomonas* spp .He also explored the possibilities for circumventing the antibiotics resistance of these bacteria by attaching such antibiotic molecules to the proper siderophore. Dr P. Cornelis, Flemish Interuniversity Instt. for Biotechnology, Belgium, explored the possibilities of fluorescent pseudomonads for the biological control of root pathogens such as *Pythium, Fusarium* and *Rhizoctonia* spp. The antifungal molecules produced by some *Pseudomonas* spp. have been identified as phenazine-1- carboxylic acid and oxychlororaphin, 2-phenazine derivatives.

In Session X-B, held under the Chairmanship of Prof. E.M. Papamichael, Dr E. Forche, Gesellschaft fur Biotechnologische Forschung, Germany, reviewed the unique biology of the order Myxobacterales with specific emphasis on its biologically active secondary metabolites such as vioprolides and phenalamides. He also expressed the need for an excellent collaboration between the different disciplines of biotechnology for the development of new pharmacologically and technologically significant products from these bacterial cultures. Prof. G.P. Agarwal, IIT, New Delhi, presented a paper on modern trends in bioprocedures for separation of valuable metabolites using ultrafiltration membranes.

Making a presentation on behalf of Prof. S. Tripathy, University of Massachusetts, USA, in Session X-A, Dr M. Ayyagiri, highlighted enzyme catalyzed polymerization of electroactive polymers. Prof. Tripathy and his co-workers had succeeded in the enzymatic synthesis of polyaniline at air-water interphase in the confined media such as micelles. Prof. N.R. Desai, UoM, Boston, USA, spoke of his group's work on the bacteriorhodopsin-mediated optical information processing such as edge enhancement, noise filtering, band pass filtering, flow visualization, beam profiling — the various steps involved in image processing using photonics technology. Bacteriorhodopsin tends itself to many manipulations through the use of the techniques of synthetic chemistry and molecular bioengineering, which permit modification of its optical properties to suit the requirements of a given technological application without degradation of its inherent mechanical and thermal stabililty or other physical characteristics. Biosensors and bioelectronics is an emerging branch of analytical science, stressed Dr M.S. Thakur, CFTRI, Mysore. These analytical devices consist of a biological recognition molecule and a transducer, which can be applied in many fields such as clinical diagnosis, food, fermentation, pharmaceutical, pollution, agriculture and defence for detecting bacteria, viruses, proteins, DNA and antigens. Computer-based bacteriorhodopsin are expected to be available in the world market soon. Such biochips would be more efficient than the conventional semiconductor-based technology, explained Dr Thakur.

Regioselective acylation of drugs is one of the methods used to isolate and purify pharmacologically active chiral compounds. In his talk in Session XI-B, Dr J.A. Akkara, US Army Natick Research Dev. & Engg. Center, USA, reported his group's work on validation of polyhydroxy compounds with site-specific acylation — a much useful step in pharmaceutical, food and biotechnology industries. In addition to the use of regioselective acylation for separation and purification of optically active chiral compounds, bioerodable transesterified polymers synthesized by this method have applications in slow release drug delivery system, entrapment and time release coatings. Dr Emm. M. Papamichael, University of Ioannina, Greece, described his group's achievement in expressing elastase and cathepsin-G enzymes on the cell surface of human PMN *in vitro*, so that their activity can not be inhibited by antiproteinases. The group had also made kinetic measurements of these enzymes from human PMN activated by PAF and suggested several explanations about the mechanism involved in the pathogenisis of inflammatory diseases. Dr M.R. Das, Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram, demonstrated the molecular biology of Indian strain of Hepatitis C Virus (HCV) with his experience of a sensitive PCR method for detection and characterization of the most immunogenic viral proteins for the development of effective detection kits.

Microbial lipases, which are classical biocatalyts in the production of speciality fats, can be designed by protein engineering for improved performance in detergent systems, in enantioselective synthesis of synthons, cosmetics and fragrance as well as in the preparation of structured triglycerides for human consumption. Other allied enzymes which have much utility in lipid biotechnology are phospholipase and esterase. Prof. F. Spener, University of Munster, Germany, keeping all these aspects in view, made a comprehensive analysis of the potential of oil seeds as cells factories for pharmaceuticals and other value-added products. Prof. K. Yokota, Shimane University, Japan, who also chaired the Session XII-A, explained the achievements of his group in the cellular interactions between n-3 and n-6 essential fatty acids for the modification of membrane phospholipids and regulation of archidonate cascades by using cultured Madin-Darby Canine Kidney cells as a model, and also focused the distinct gene expression pattern of cyclo-oxygenase isoforms involved in the rate limiting step for arachidonate cascades following modification with n-3 and n-6 unsaturated fatty acids.

Chaired by Emm. M. Papamichael, Session XII-B also had two presentations. Dr S.N. Nene, NCL, Pune, explained the methods employed for the concentration of foot and mouth disease and clostridial type D toxoid using various ultrafiltration membranes. Dr D. Pillay, University of Durban-Westville, South Africa, presented his paper on extrachromosomal and chromosomal DNA analysis of *Xanthomonas albilineans* isolates.

The last day of the seminar had four technical sessions followed by a panel discussion. Chaired by Dr Bharat Patel, Session XIII-A had the following four presentations: 'Steroid Biotransformation: A Glimpse of Indian Scenario' by Dr S.B. Chincholkar, North Maharashtra University, Jalgaon; 'Multifunctional Glucanaes from *Cellulomonas* spp.' by Prof. D.N. Deobagkar, University of Poona, Pune; 'The Effect of *p*H, Superficial Air Velocity and Initial Protein Concentration on the Foam, Fractionation of Egg Albumin' by Prof. R.D. Tanner, Vanderbilt University, USA; and 'Genetic and Biochemical Studies on the Polysaccharides Production by Marine Bacteria' by Prof. S. Jayachandran, Pondicherry University. Prof. D. Singh chaired the Session XIII-B. The four presentations made in this session are: Microbial Process for Decolourization of Textile Dyes and Effluents using Mesophilic and Thermophilic Microbes, by Dr Poonam Nigam, University of Ulster, UK; Microbial Degradation of Chlorinated Phenols and Other Halogenated Aromatics by Dr G. Szakacs, Technical University of Budapest, Hungary; Effects of Photographic Waste Components on Silver Recovery, by Dr W.A. Ahmad, Universiti Teknologi, Malaysia; and Reclamation of the Heavy Metal-bearing Wastewaters using Biosorptive Process:

Seen on the dais during the Plenary Session of the International Conference on Frontiers in Biotechnology (*from left*) are: Dr J.M. Meyer, Prof. R. Marchant, Dr Vijay Nair, Dr F. McSweeney, Prof. H. Veeramani and Prof. D.N. Deobagkar; and a view of the audience

A Case of Gold Recovery' by A.K. Mittal, National University of Singapore.

The Sessions XIV A&B had presentations on: 'Biotechnological Approach for Bioconversion of Lignocellulosic Wastes' by Dr A. Prakash, Barkatullah University, Bhopal; 'Utilization of the Edible Mushroom *Pleurotus ostreatus* for Lignin and Polyaromatic Hydrocarbons' Biodegradation' by Prof. Yitzhak Hadar, The Hebrew University of Jerusalem, Israel; Enzyme-mediated Removal of Hexavalent Chromium — Isolation and Characterization of a Bacillus Chromium Reductase' by Dr P. Prema, RRL- Thiruvananthapuram; 'Detoxification of Chromium-containing Industrial Effluents' by Dr A.K. Tripathi, BHU, Varanasi; 'Microbial Techniques for the Treatment and Management of Wastewaters and Residues from Cassava Starch/Sago Industries' by Dr C. Balagopalan, Central Tuber Crop Research Institute, Thiruvananthapuram; 'Microbial Decolourization and Bioremediation of Anaerobically Digested Molasses Distillery Spent Wash from Methane-producing Effluent Treatment Plants' by Prof. D. Singh, CCS Haryana Agricultural University, Hisar; Future Possibilities of Research in Anaerobic Processes by Dr S.N. Kaul, NEERI, Nagpur; and 'Biotechnology; Current Status' by Dr Ved Malik, USDA, USA. Dr Malik in his lecture presented the scenario prevailing in USA in the area of genetic engineering of crops.

Panel Discussion

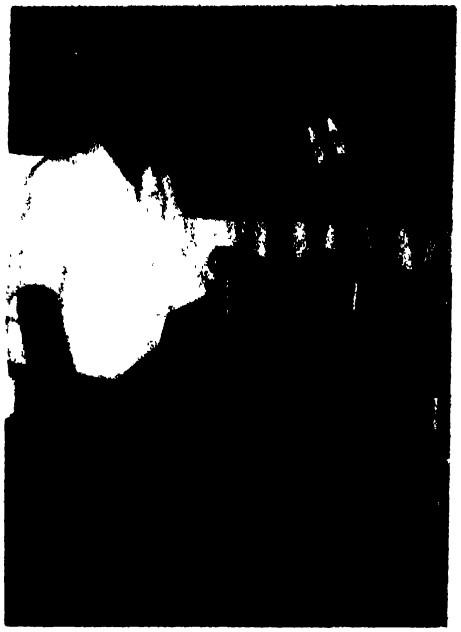
The panel discussion was held under the chairmanship of Dr Vijay Nair, Director, RRL-Thiruvananthapuram, on the theme 'Status of Biotechnology in 2010 and Beyond'. The panelists were: Dr F. McSweeney, Prof. Roger Marchant, Dr J.M. Meyer, Prof. H. Veeramani and Prof. D.N. Deobagkar.

Dr McSweeney expressed that the growth in the area is so fast that slowly the term 'Biotechnology' will start disappearing and will be replaced by a number of narrower, more focussed terms like 'Gene Therapy' and 'Protein Engineering'. Interface between food and pharmaceutical industry will increase and the latter will not only depend on development of newer chemicals but also on recombinant DNA techniques, etc. International collaboration in the area will increase and all this will offer a good opportunity in the Indian context. The local industry will not count much; it will be confined only to the local markets. Referring to the 'Human Genome Programme', Dr McSweeney opined that this programme will serve as the key for further developments. Fundamental research will continue at the national levels, but the major directions in the industrial and economic R&D will be decided by just 5-6 giant companies.

Dr Meyer expressed his happiness over the vast coverage of areas in biotechnology in the posters displayed during the conference.

Prof. Marchant said that the area of Environmental Research involves several groups with specific objectives, the microbiologists, biochemists, analytical chemists, biochemical engineers and so on. Future of Environmental Biotechnology lies in the hands of the governments and not specifically in the hands of scientists. Hopefully, governments will take a pragmatic view and pursue environmenal cleanliness programmes with all enthusiasm. Referring to the posters which covered a large number of areas , Prof. Marchant cautioned that keeping in view the limited resources of the country, India should concentrate on fewer areas and should build centres of excellence with right kind of people and infrastructure.

Responding, Prof. Deobagkar pointed out that the problem of infrastructural facilities is not only in India but in most of the developing countries. Facilities, no doubt, are required and that is exactly what is being planned by the Government of India. Prof. Deobagkar expressed that the rich biodiversity is the plus point with India. But we should know what we are doing and our efforts should lead to worthwhile technologies. Awareness should be created as to how to collaborate with groups working outside, and also about the modern information channels available. Basic research is equally important, he added.



Dr Ashok Pandey proposing a vote of thanks

Prof. Veeramani spoke on the emerging trends in the treatment of hazardous wastes with biotechnological applications. He expressed that a large amount of expertise is available but the need is to have 'lab to field' programmes.

Dr McSweeney observed that India has several centres of excellence in the area. Citing an example, he said costwise, the R&D output at IISc in Bangalore is more than in many institutes in Europe. The country has far more scientists than even the western European countries and this offers tremendous opportunities for the companies struggling for resources to work in India.

Dr Mukherjee mentioned about the various schemes of the financial institutions in the country, to support R&D.

Awards were given to the outstanding posters.

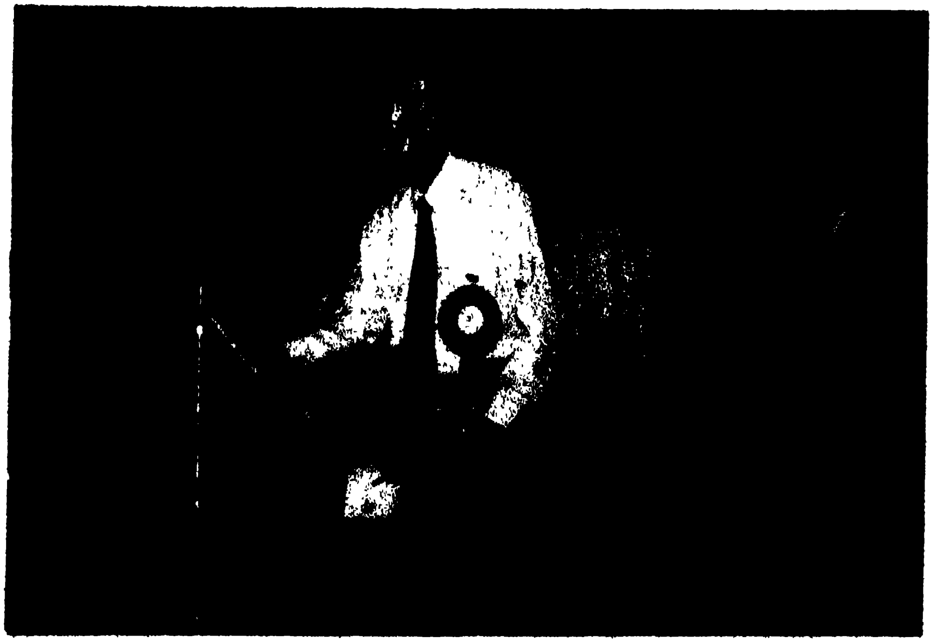
The conference ended with a vote of thanks by Dr Ashok Pandey, Scientist, RRL-Thiruvananthapuram, and Convener of the Conference. ❑

International Conference on Pressure Vessels and Piping

AN International Technical Conference on 'Pressure Vessels and Piping' was organized by the Design Engineering Division of Indian Institute of Chemical Technology (IICT), Hyderabad, on 22- 24 October 1997. Shri R.N. Parlikar, Sr. Deputy Director & Head, Design Engineering Division, IICT, was the convener of the conference.

Over 150 delegates from the Indian industry, research institutes and consultancy firms participated in the three-day long deliberations, which were also attended by participants from USA, Canada, Germany and South Africa. The conference was co-sponsored by M/s Newton Engineering & Construction Co. Ltd, Baroda; M/s NILE Ltd, Hyderabad; M/s Tata Projects Ltd and Tata ELXSI India Ltd, Hyderabad; BHEL, Hyderabad and M/s Sathom Engineering Ltd, Hyderabad, etc. The deliberations were held in nine technical sessions, in addition to the inaugural and valedictory session.

The conference was inaugurated by Dr R.A. Mashelkar, Director General, CSIR and Secretary, DSIR, Government of India, who was the chief guest on this occasion. In his address he praised the contributions of Design Engineering Group, particularly the services offered by this group to the Indian industry. He said that this was the only place in CSIR where a complete Design Engineering Package is provided, which meets all the requirements the client needs to erect and commission a chemical process plant. He said that though the growth of CPI in India has been spurred by the ever increasing number of overseas collaborations that the Indian industry sought, the time has come for the Indian industry to encourage the indigenous technologies developed in CSIR laboratories/institutes which have acclaimed international recognition and excellence. He also emphasized that the Indian engineers now have the necessary skills, dedication and commitment to carry out a job.



Dr R.A.Mashelkar inaugurating the International Conference on 'Pressure Vessels and Piping' held at IICT

In his welcome address, Dr K.V. Raghavan, Director, IICT, referred IICT as one of the few institutes in India which realized the importance of industry participation by working in close association with them. He said that the Design Engineering Division has the rare distinction of interacting constantly with the industry by organizing short-term technical courses on a variety of topics for the benefit of all professionals. The present international conference on Pressure Vessels and Piping is another step in that direction, he added.

Shri Parlikar, convener of the conference, introduced the theme of the conference. He said that the emphasis of the conference was on the technology and science related to the pressure vessels and piping and it aimed to discuss various issues on the design analysis, materials, fabrication, equipment, operation/maintenance, inspection, codes/standards and reliability. He hoped that the conference would provide enough opportunity for useful interaction between the delegates and be beneficial to them, and generate interest and pave way for organizing such conferences once in every two years.

Smt. Sheela Bhide, Secretary, Industries & Commerce, Government of Andhra Pradesh, who presided over the function, said that the State Government is committed to provide all the necessary infrastructure and support to the new entrepreneurs in the state. She complimented IICT for having maintained a good link with the industry and cited the programmes taken up by IICT for the development of the country.

Shri P.M. Mehta, Vice President, Larsen & Toubro Ltd, Mumbai, in his key-note address, highlighted the progress the country has made in the area of Pressure Vessel Technology— its design and fabrication.

Shri G.V. Yugandhar, Dy. Director, DED, proposed a vote of thanks.

There were 14 invited lectures and 35 paper presentations in nine technical sessions. The two-volume conference proceedings has been edited by Shri R.N. Parlikar and Shri G.V.Yugandhar. Added attraction of the conference was an exhibition related to Pressure Vessel Products & Softwares. Leading manufacturers such as Tata Projects, Blue Star, HiTech Industrial Implements, Mumbai; SST India Ltd, Bangalore; EMRC, Bangalore; and Madhu Chit Industries, Mumbai, displayed their products. ❑

Get-together with Industries

A Get-together with industries and entrepreneurs arranged in connection with the Golden Jubilee Celebrations of Central Electrochemical Research Institute (CECRI), Karaikudi, and Silver Jubilee Celebrations of CECRI, Madras Unit was held at CMC Conference Hall, CSIR Complex, Chennai.

Shri K.V. Rangaswamy, Scientist-in-charge, CECRI Unit, Chennai, delivered the welcome address. Shri B. Sathayanandam, Head, Scientific Industrial Liaison and Extension Division of CECRI, introduced the delegates to the audience.

Shri K. Dakshinamurthi, Scientist and Head, Battery Testing Centre, CECRI Unit, Chennai, explained the aim of the get-together, which was to generate awareness among the industries and entrepreneurs regarding the entire gamut of technologies developed and being developed at CECRI, and also to get a feed- back from the industries on the services offered by the CECRI Unit in the areas of battery testing, and testing and analysis in metal finishing and corrosion.

Prof. G.V. Subba Rao, the then Director, CECRI, in his address enumerated the technologies developed and commercialized, and also the technologies being developed and in the pipeline. He also spoke about the programmes and activities of different divisions of CECRI, Karaikudi, and various Units of CECRI, at Cochin, Madras, Mandapam and Tuticorin.

Shri M. Sivaswamy, General Manager (R&D), Manali Petrochemical Ltd, Chennai, in his inaugural address appreciated the achievements of the institute and suggested that an electrochemical route for the preparation of FLEXIGLASS may be explored.

Dr T.V.S.R. Appa Rao, Director, SERC, and Coordinating Director, CSIR Madras Complex, in his address paid rich tributes to CECRI for its achievements and appreciated its efforts to maintain and sustain its contact with industries. He later released a souvenir brought out on this occasion.

Shri T. Ranganathan, Managing Director, MFB Industries Ltd, Chennai, declared open an exhibition of CECRI technologies arranged at the same venue. Shri K.E. Sanath Kumar, Scientist SD, National Test House (NTH), Southern Region, Chennai, expressed his happiness for being associated with the function as NTH is also a servicing organization engaged in testing and evaluation of various materials and products. He later released a booklet on the non-technical notes of CECRI technologies.

Mementoes were presented to the following companies associated with CECRI in the get-together: M/s Standard Batteries Ltd, Chennai; M/s IR Technology Services Private Ltd, Bangalore; M/s MFB Industries Ltd, Chennai; and M/s Jeyam Scientific Company, Chennai.

As a remembrance of the valuable services rendered by the retired scientist-in-charges of the CECRI Madras Unit, mementoes were presented to them. They are: Shri N. Balasubramanian (1962-1971), Shri G.S. Subramanian (1971-1983), Dr N.V. Parthasaradhy (1983-1992), and Shri R. Viswanathan (1992-1993).

Mementoes were also presented to Shri K. Dakshinamurthi (S), CECRI Madras Unit, who served as Scientist-in-charge (SIC) during the years (May 1993- September 1996) and to Shri K.V. Rangaswamy, the present SIC. The vote of thanks was proposed by Shri S. Ramamurthy, CECRI Madras Unit, and Convener of the get-together. ❑

National Conference and Refresher Course on Industrial Metal Finishing and Electroplating with emphasis on Pollution Control Measures

THE Swadeshi Science Movement of India, Delhi (SSMD), in collaboration with the Central Electrochemical Research Institute (CECRI), Karaikudi, organized a National Conference and Refresher Course on Industrial Metal Finishing and Electroplating with emphasis on Pollution Control Meausres, at IARI, New Delhi, during 10-13 November 1997. The programme was sponsored by the Council of Scientific & Industrial Research and the Department of Science & Technology, New Delhi. Over 100 delegates from different parts of the country participated.

Dr R.A. Mashelkar, Director General, CSIR and Prof. G.V. Subba Rao, the then Director of CECRI, in their congratulatory messages stressed on the need for controlling environmental pollution which is an invariable associate of the plating processes. They called upon metal finishers to adopt the newer environment-friendly technologies in view of their regeneration capabilities.

Inaugurating the programme, Shri Sahib Singh, Chief Minister, Delhi Government, lauded the efforts of SSMD in spearheading the task of propagating Science & Technology in Indian languages for the overall benefit of the society. He also appreciated CECRI, one of the collaborators, for the development of a large number of electrochemical technologies. He offered cooperation and help of his government in matters of pollution-related problems, provided the organizers come forward with concrete proposals.

Prof. R.B.Singh, Director, IARI, welcomed the gathering. Dr O.P.Bahl, Vice President, SSMD and Scientist, NPL, highlighted the agenda of the programme. He pointed out that electroplating industry experiences corrosion problems of different types and nature every day, which have to be well understood and combated effectively. He also mentioned about the huge losses to the country owing to corrosion, which are estimated to be around Rs 80,000 million per annum.

Prof. K.I. Vasu, former Director, CECRI and National Coordinator, SSM, said that knowledge about advances in electroplating would reach factory workers only when special courses are conducted in their own native languages. Dr D.P. Bhatt, Coordinator of the present programme and Scientist, NPL, opined that prospects of the metal finishing industry are bright. There are over 30,000 registered 'metal finishers' in the country employing about 500,000 people, and about five times as many unregistered finishers. In Delhi alone, there are more than 2000 electroplating units. However, some of these have been closed down or are being asked to shift to other places in view of the strictures imposed on them by the Supreme Court, for not following the pollution control measures. And unfortunately many of these have only a limited awareness about the pollution control measures, Dr Bhatt added.

An important feature of the programme was the release of a bilingual (Hindi & English) publication on 'Electroplating and Metal Finishing' (editor: Dr D.P. Bhatt) by Prof. A.K. Raychaudhury, Director, NPL.

Prof. K.I. Vasu, former Director of CECRI and National Coordinator, SSM, addressing the participants of National Conference and Refresher Course on Industrial Metal Finishing and Electroplating with Emphasis on Pollution Control Measures. Sitting on the dais (*from left*) are: Dr D.P. Bhatt, Prof K.L. Chopra, Dr O.P. Bahl, Prof. Chandra Shekhar, Shri Sahib Singh and Dr S.S. Aggarwal

Shri Sahib Singh released a souvenir brought out on the occasion.

The programme comprised one plenary lecture, three invited lectures and nine contributed papers. It had four technical and eight modular sessions.

The first technical session was chaired by Dr S.S. Aggarwal, Managing Director, Foundry Chemical Industries P. Ltd, New Delhi. Prof. Vasu gave a plenary lecture on 'Metallurgical purposes of metallic coatings'. The lecture dealt with aspects such as ease of soldering, possibility of soldering of the normally non-solderable alloy systems, surface modification and reduction of friction for tribological purposes, and optical and magnetic properties. Dr K.N. Srinivasan presented a paper on 'Nickel-phosphorus-silicon carbide composite coating from an hybrid sulphamate electrolyte'. The paper provided information on wear resistance and hardness of the composite coating with the incorporation of refractory silicon carbide powders in the baths. Other two contributions in this technical session were on 'Electroless nickel on steel' and 'Electrodeposition of bismuth from complexed aqueous acidic bath' by Shri M.N. Darji of SVR College of Engineering and Technology, Surat and Dr J.D. Desai of Gautam Arts and Sanjivni Commerce College, Ahmednagar, respectively.

Dr Inder Singh, Dy. Director of National Metallurgical Laboratory, Jamshedpur, chaired the second technical session. Dr A. K. Sharma, Head, Thermal Process Section, ISRO Satellite Centre, Bangalore, delivered an invited talk on 'Electrochemical coatings for thermal control of spacecraft'. He narrated the development of protective coatings on magnesium-lithium alloys for their first time successful application in the INSAT 2B, C and D spacecrafts. Shri P. Veeramani of CECRI spoke on the treatment of wash water of chromium plating using solar still. In the subsequent presentation on 'Studies on kinetics of electrode processes during electrodeposition of zinc-cobalt alloy from ammoniacal acetate bath', Dr R.V .Anyapanawar of Sangameshwar College, Solapur, described the operating conditions of the bath so that the adherency and appearance of the alloy deposit can be achieved successfully.

The third technical sesison was chaired by Dr A.K. Sharma, Head, Thermal Processes Section of ISRO Satellite Centre, Bangalore. Dr Gurmeet Singh of Delhi University, who was an invited speaker, gave an interesting overview on 'Corrosion inhibitors — industrial practices'. Dr Visalakshi Ravindran of CECRI presented the developmental R&D work on complexing and non-complexing, eco-friendly zinc electroplating baths based on NTA, gluconate and tartarate.

Shri S.V. Kulkarni, Managing Director of Shree Rasayani, Nasik, chaired the fourth technical session. He also gave an invited talk highlighting the recent developments in the production of zinc alloys and the comparative profile with respect to conventional plating, Shri S. John of CECRI spoke on utilization of the copper and nickel electroforming processes for production of cryogenic rocket engine thrust chambers. Shri John also presented a paper entitled 'Studies on high-throw acid copper for through hole plating of printed circuits and for electroforming applications'. Shri T. Bhujanga Rao of CECRI gave an account of his research work on 'Electrophoretic painting based on different metallic substrates, which included synthesis of acrylic-based cataphoretic painting system, some experiments on CED to examine the nature of current with time, effect of *p*H & voltage, etc.

In the first modular session of the refresher course, Dr Inder Singh, Dy. Director of NML, dealt with the various aspects of corrosion and their preventive measures and pollution control considerations. Highlight of the presentation was the remarkable work of NML on control of pollution owing to hexavalent chromium. A process to make zinc tetroxy chromate from chromate effluent was also described. Km Divya Sinha, Asstt. Director of National Productivity Council, New Delhi, systematically touched upon the practical aspects in solving environmental problems in electroplating industries. Shri J. Ayappa Raju of CECRI spoke on 'Industrial anodizing of aluminium and its alloys' and 'Electrolytic colouring of anodized aluminium'. Shri S. John of CECRI chaired the session.

Presentations in the subsequent modular sessions included: 'Fundamental aspects of metal deposition' by Dr G.N.K. Ramesh Bapu (CECRI), 'Recent trends on copper, nickel and chromium platings' by Dr S. Sriveeraraghavan (CECRI), 'Electroless plating' by Dr K.N. Srinivasan (CECRI), 'Zinc plating' by Shri J. Ayappa Raju (CECRI), 'Dacrotizing' by Shri V. Ralhen (Grauer & Weil (I) Ltd, New Delhi), 'Electro composites' by Dr G.N.K. Ramesh Bapu (CECRI), 'Conversion coatings' by Dr A. K. Sharma (ISRO Satellite Centre, Bangalore), 'Electroforming' by Dr K.N. Srinivasan (CECRI), 'Testing of electrodeposits' by Dr G.N.K. Ramesh Bapu (CECRI), 'Control of electroplating solutions using Hull cell studies' by Dr K.N. Srinivasan (CECRI), 'Plating of precious metals' by Dr S. Sriveeraraghavan (CECRI), 'Indian Standards on characterization of metal deposits' by Shri N. Mitra (Director, Bureau of Indian Standards, New Delhi) and 'Control treat and recover waste' by Shri A.K. Joshi (Sr. Technical Manager, Platewel Processes & Chemicals, Baroda).

Dr S. Sriveeraraghavan and Dr G.N.K. Ramesh Bapu of CECRI, Shri R. Ramesh of YKK (I) P. Ltd (Delhi), Dr V.N. Ojha, Dr D.K. Suri and Dr D.P. Bhatt of NPL, were the chairpersons of these different modular sessions.

Focus of the panel session was on implications of pollution to the metal finishing industry. Emphasis was given to the interaction between industry and research & development organizations. Dr D.P. Bhatt chaired the panel session. Panel members were: Dr S. Sriveeraraghavan, Dr D.K. Suri, and Dr V.N. Ojha. The main message emerged was that the construction of common community treatment plants could be made in order to dispose the toxic plating chemicals let out from the plating baths. An interfacing of the pollution control boards and the industries with the prominent laboratories like CECRI, was recommended for achieving fruitful results in this direction. It was also recommended that NPL may be approached for fabrication of mass standards befitting the interest of the platers.

Certificates were given to the participants of the refresher course.

Dr D.P. Bhatt proposed a vote of thanks. ❑

WORKSHOPS

ICS-UNIDO International Workshop on Environmentally-degradable Polymers

THE National Chemical Laboratory (NCL), Pune, hosted the ICS- UNIDO International Workshop on Environmentally - degradable Polymers, under the auspices of the International Center for Science and High Technology (ICS), Trieste, Italy, a constituent organization of UNIDO, Vienna. The workshop focussed on one of the major concerns of our times, namely, the environmental friendliness or otherwise of polymers. Polymers have become an indispensable part of our every day life and their consumption in developing countries is witnessing a phenomenal growth. It is, therefore, imperative that countries like India, address the issues related to life cycle assessment of polymers and their fate in the environment. The relative importance of recycling of biodegradable materials needs to be understood and material choice for given applications must emerge out of a judicious balance of sustainable environment and the cost to be borne by the consumer. There is an urgent need to define the future material choices, especially, for packaging applications, which is one of the most significant causes of litter in the urban landscape.

The workshop aimed at imparting contemporary knowledge of principles and fundamentals of environmentally-degradable polymers, their applications, and addressed critical issues that need resolution. It offered a platform where the developed and developing countries exchanged ideas, shared experiences and considered potential solutions. The workshop addressed topics such as Environmentally-degradable polymers; Design of environmentally-degradable polymers; Recycling of polymers: Mechanisms operating in environmental degradation of polymers: Standards, testing and evaluation methods; Legislative aspects and public perceptions; Specific biodegradable polymers; and applicaions of biodegradable polymers.

The workshop was inaugurated by Prof. S. Miertus, ICS, and Dr E. Chiellini of University of Pisa, Italy. More than 40 foreign delegates from USA, UK, Switzerland, France, Holland, Sweden Egypt, Italy, Cambodia, Vietnam, Malaysia, Indonesia, Bangladesh, Qatar, UAE, China, Iran, and Nepal, besides India participated. Welcoming the delegates, Dr S. Sivaram, Workshop Co-Director, and Head, Polymer Chemistry Division, NCL, gave the genesis and importance of organizing the workshop in a Third World Country, particularly in a developing country like India. Dr Sivaram stressed that there is an urgent need to define future material choices, especially for packaging applications, which is one of the most significant cause of litter in the urban landscape.

Prof. Miertus, Associated Area Coordiantor of the International Centre for Science and High Technology

Dr E. Chiellini, Dr S. Sivaram, Prof. S. Miertus and Dr A.J. Varma during the inauguration the ICS-UNIDO International Workshop on 'Environmentally - degradable Polymers' at NCL.

(ICS), in his inaugural address said that since 1988, ICS had been directing its efforts towards three main areas: pure and applied chemistry; earth, environmental and marine sciences and technologies; and high technology and new materials.

Prof. E. Chiellini, University of Pisa, in his keynote address narrated the increased consumption of plastics which are convenient and useful to human life. However, their use has ultimately resulted in the serious issue of plastic waste generation. He further mentioned that the usage of plastic materials for commodity and speciality plastic has to face diverse constraints and regulations already operative or to be issued in future, dealing with management of primary and post- consumer plastic waste. In this connection, the formulation of environmentally-degradable polymeric material will constitute a key option among those available for the disposal/management of plastic waste.

An overview of environmentally degradable polymers can not be treated outside the framework of global issue related to the waste production and relevant management. The issue would need to be addressed by plastic manufacturers, polymer scientists and citizens and public officials. The subject matter requires proper definition comprising all the possible categories of environmentally-degradable polymers, together with suitable standards and testing protocols.

In short, no universal standards and testing protocols can be selected to assess the environmental degradability of polymeric materials. Specific environmental conditions and relevant test protocols have to be defined implying the knowledge of adequate physical parameters and microbial strains eventually utilized in the evaluation tests.

Dr A.J. Varma, Scientist, Polymer Science & Engineering Division, proposed a vote of thanks. ❑

Workshop on Patents

A two-day workshop on 'Intellectual Property Rights' was organized at the Indian Institute of Chemical Biology (IICB), Calcutta, during 18-19 September 1997 under the sponsorship of CSIR and Pfizer, USA. Mr Amal Naj, Mr Gorlin and Mr Lumb, all from Pfizer, USA, having expertise in various facets of IPR including legal and technical aspects, were the three speakers at the workshop.

Dr J. Das, Director, IICB , in his opening remarks, said that the aim of this training cum workshop is to increase the value and volume of IPR in CSIR. He further said that initially a series of programmes were organized to increase the awareness on IPR. As a result, a level of awareness has already been generated among CSIR scientists about the importance of intellectual property rights. Having done so, it is now appropriate to organize programmes that would lead to enhancing both the value and volume of IPR. This workshop is directed in this direction, he added.

Dr Das also pointed out that during last one decade, there has been a sea-change in the economic and political patterns all over the world. The GATT negotiations and formation of World Trade Organisation (WTO) are some of the symptomatic expressions of this change. Even the socialist countries are opening their markets to a significant extent. Under these situations, initial expression of concern and fear in our country has been replaced by more pragmatic approach based on ground realities. As a result, a lot of awareness has been generated about patent regime. He hoped that this workshop will take

Dr I. Das, Director, IICB, presenting memento to one of the speakers, during the 'Workshop on Patents'

us a step forward in consolidating our patent regime.

The technical sessions of the workshop were very lively with active participation by the delegates. The speakers were given mementoes on behalf of the organizers. ❑

TRAINING PROGRAMMES

Production of Glazed Wall Tiles in Small-scale Sector

THE Central Glass & Ceramic Research Institute (CGCRI), Calcutta's Naroda Centre conducted a training-cum-demonstration programme on 'Production of Glazed Wall Tiles in the Small-scale Sector' during 17-21 November 1997.

CGCRI has standardized the formulations for opaque & transparent frits and the matching glazes for wall tiles to meet the requirements of the users and transferred the know-how. Special emphasis was laid on the manufacturing of comparatively low-temperature/low-cost frits utilizing the indigenously available raw materials and chemicals.

The one-week programme comprised theoretical lectures and practical demonstrations covering the following aspects: Present status of tiles production in India and abroad; Basic raw materials and their characteristics; Preparation of tile bodies and making of tiles: Wall tile frits & glazes; Kiln furniture for wall tile production; Preparation of frits; Firing & ceramic kilns; Decoration of wall tiles; Testing & quality control of glazed wall tiles; Defects in wall tile production & their remedies. Nine participants attended the programme. ❑

Capsule Courses in Ceramic Technology

THE Central Glass and Ceramic Research Institute's Naroda Centre, conducted six capsule courses: (i) Ceramic raw materials - properties and uses; (ii) Processing and grinding of non-plastic raw materials; (iii) Different types of Ceramic bodies; (iv) Medium temperature (1200°-1280°C) ceramic glazes; (v) Ceramic firing and firing schedules, and (vi) Defects and remedies in ceramic bodies and glazes, during 22 September-6 October 1997. Each programme had three lectures, except the one on 'Ceramic Raw Materials — Properties and Uses' which was of five lectures. The topics covered in these courses are: Geology, occurrences, reserves and beneficiation of ceramic raw materials in Gujarat; Physico-chemical properties of some important ceramic raw materials of Gujarat; Major ceramic raw materials (plastic & non-plastic) for white ware industry; Importance of quality of ceramic raw materials on the properties of traditional ceramic products; Process control of raw materials in a ceramic laboratory; Ceramic non-plastic raw materials and their mechanical preparation; Fine grinding of non- plastic materials and grinding equipment; Importance of particle size and distribution on the thermo-mechanical properties of traditional ceramic materials; Classification and composition of different ceramic bodies; Raw materials — their functions, specifications, effect of impurities as well as compounding of traditional ceramic bodies; Techniques of body preparation; Introduction to ceramic glazes - definition, classification, desired properties of glazes, function of raw materials and specifications; Compounding of glazes — governing factors, glaze calculations, manufacturing process & glaze control methods, additives, binders, etc; Glaze application and properties (different application methods, glaze properties & glaze fitness, glaze defects, etc.); Introduction to ceramic firing and pyrochemical reactions in ceramic bodies; Derivation of firing schedules and maturity of ceramic wares; Ceramic kilns and firing operations leading to energy conservation; Defects and remedies in bodies and glazes for the production of glazed wall tiles as well as crockery and sanitary wares.

The faculty members included: Dr K.N. Maiti, Head, Traditional Ceramics & Rural Pottery Division; Shri S.K. Mukherji; Shri R.B.V. Subramanian; Shri H.M. Shah; Shri R.M. Savsani; Shri B.B. Machhoya, all from CGCRI Naroda Centre; Shri A.K. Gupta, CGCRI Khurja Centre; and Shri V.G. Malkan, Retd. Senior Chemist, Directorate of Geology & Mining (DGM), Gandhinagar. Nine out of the total nineteen lectures were delivered by Dr Maiti, three by Shri Mukherji, two by Shri Malkan and one each by other faculty members. All the lectures were followed by panel discussion with regard to the problems faced by the industries in respect of the particular unit operation.

About 125 participants attended these courses, many of them from the medium and large-scale manufacturing units, though the courses were intended for small-scale sector. The participants highly appreciated the selection of the topics as well as the updated and the extensive information provided by the lectures. ❑

ANNOUNCEMENTS

International Symposium on Information Technology in Oceanography

THE National Institute of Oceanography (NIO), Goa, is organizing an International Symposium on 'Information Technology in Oceanography' (ITO-98)' during 12-16 October 1998, at NIO. The aim of ITO-98 is to bring information managers, ocean industry persons, scientists, researchers and academicians to a common forum to review the application of information technology in the area of oceanography.

The symposium will deal with all aspects of Information Technology applications. Management Information Systems, and Human Resource Management for IT applications in Oceanography.

Its objectives are to assess the requirements of end-users (scientists, researchers, industry) and to find means of IT to increase the efficiency and effectiveness of ocean industry.

Original contributions in the following topics are invited:

- Role of Libraries, Information Centres, Information Systems & Networks in Oceanography
- Data Acquisition & Database Management in Oceanography
- Mathematical Modelling and Advanced Computer Simulation in Oceanography.
- Remote Sensing, GIS, Multimedia and CAD/CAM Applications in Oceanography
- Expert Systems, Analytical & Forecasting Tools and Virtual Reality in Oceanography
- Internet and Intranet in Oceanography
- Under water and maritime Communication
- Ocean Engineering & Instrumentation (Robotics, ROVs, ROSS and Submersibles)
- Computer Aided Learning and Management Information System in Oceanography
- Human Resource Development and Infrastructure Building in ITO

Abstracts (not more than 250 words) should be submitted to: Shri Vishwas Chavan, Organizing Secretary, ITO-98, National Institute of Oceanography Dona Paula, Goa 403004, India. E. mail: ito 98@ csnio, ren. nic.in; Fax: +91 832 223340/229102. ❑

NAL-UNI LECTURE SERIES

Experimental Aerodynamics

EXPERIMENTAL aerodynamics has played a key role in the design of flight vehicles, and experimental research has contributed significantly to the understanding of many non-linear flow phenomena, for example turbulence, vortices, shock waves, separation and reattachment. Owing to the indigenous development of aerospace vehicles during the last two decades, this field has seen a rapid growth in the country and at the National Aerospace Laboratories (NAL), Bangalore, in particular. Several special techniques have been successfully developed and applied at NAL, for various national projects. The main objective of the title lecture series, to be held at NAL's Belur Campus during 3-6 February 1998, is to share this vast knowledge and expertise gained at NAL with practising aerodynamicists in the different R&D organizations, faculty/research scholars and students interested in the broad field of experimental aerodynamics. Lectures will be delivered by scientists who have been actively engaged in the development and application of these techniques.

The programme will cover the following topics: Introduction to high speed wind tunnel testing — an overview; Force/moment measurements using strain gauge balances; Introduction to the design of balance; Data acquisition, processing and data-base management systems; Steady and unsteady pressure measurements; Thermal anemometry; Laser Doppler Velocimetry; Measurement uncertainties; Dynamic stability measurements; Intake performance measurements; Afterbody drag measurements with jet flow; Weapon integration studies; Booster separation studies using semi-captive trajectory system; and Buffet measurements.

Practical demonstrations will include: Laser Doppler Velocimetry; Captive trajectory system; Force measurements in the tunnel; and Database management system.

Scientists, practising engineers and research students with BE/ME in aerospace engineering are eligible for the course. Faculty for the course will comprise V, Kanagarajan, K.T. Madhavan, G. Narayan, A. Prabhu, E. Rajagopalan, M.S. Rajamurthy, G. Rajendra, G. Ramesh, Sajeer Ahmed, S.N. Seshadri, H. Sundara Murthy, G.K. Suryanarayana, R.S. Verma, and P.R. Viswanath.

Course fee is Rs 2500 and 35 persons will be accomodated in this course.

For further details please contact: Dr G. Prathap, Convener, NAL-UNI Programme or Shri M.R. Narasimha Swamy, Head, Technical Secretariat, National Aerospace Laboratories, Post Bag No 1779, Bangalore 560 017, Tel: 080-5273351, 5271112, Fax: 080-5260862, Telex: 0845-2279 NAL IN. ❑

NOMINATIONS INVITED

Shanti Swarup Bhatnagar Prizes in Science and Technology for 1998

NOMINATIONS are invited by the Council of Scientific and Industrial Research (CSIR) for the Shanti Swarup Bhatnagar (SSB) Prizes in science, including engineering and technology for the year 1998. The SSB prizes are to be given for research contributions made primarily in India during the past five years. The age of the nominees for the 1998 SSB prize should not be more than 45 years as on 31.12.1997.

The SSB prizes, each of the value of Rs 1,00,000 (Rupees one lakh only) may be awarded for notable and outstanding research, applied or fundamental, in the following disciplines: (1) Biological Sciences, (2) Chemical Sciences, (3) Earth, Atmosphere, Ocean and Planetary Sciences, (4) Engineering Sciences, (5) Mathematical Sciences, (6) Medical Sciences and (7) Physical Sciences.

Nominations should be sent as per the prescribed proforma (25 copies) along with one set of reprints of significant publications of last 5-year period by **31 March 1998** to the Head, Human Resource Development Group, Extramural Research, CSIR Complex, Pusa, New Delhi 110 012. The proforma for nomination may be obtained from the above address.

CSIR Young Scientist Awards for 1998

NOMINATIONS are invited by the Council of Scientific and Industrial Research (CSIR) for the 1998 CSIR Young Scientist Awards. The awards are to be given for research contributions made primarily in India during the past five years. The age of nominees should not be more than 35 years as on 26 September 1997. Regularly employed scientists working in CSIR system are eligible.

The awards, each of the value of Rs 25,000 (Rupees twenty five thousand only) are given annually in the following disciplines: (1) Biological Sciences, (2) Chemical Sciences, (3) Earth, Atmosphere, Ocean and Planetary Sciences, (4) Engineering Sciences, and (5) Physical Sciences (including instrumentation).

Nominations should be sent by **15 February 1998** as per the prescribed proforma (20 copies) along with one set of reprints of research papers published during last 5-year period to the Head, Human Resource Development Group, Extramural Research Division, CSIR Complex, Pusa, New Delhi 110 012. The proforma for nomination may be obtained from the above address. ❑

Printed and Published by Dr G.P. Phondke, Director, National Institute of Science Communication (NISCOM), Dr K.S. Krishnan Marg, New Delhi -110 012
Printed at NISCOM Printing Unit
Annual Subscription : Rs. 60
Editors : Dr B.C. Kashyap and Dr C.S. Gupta
Editorial Assistant : Neelima Handoo
Production : Kaushal Kishore
Single Copy : Rs. 3.00